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Ahoy!

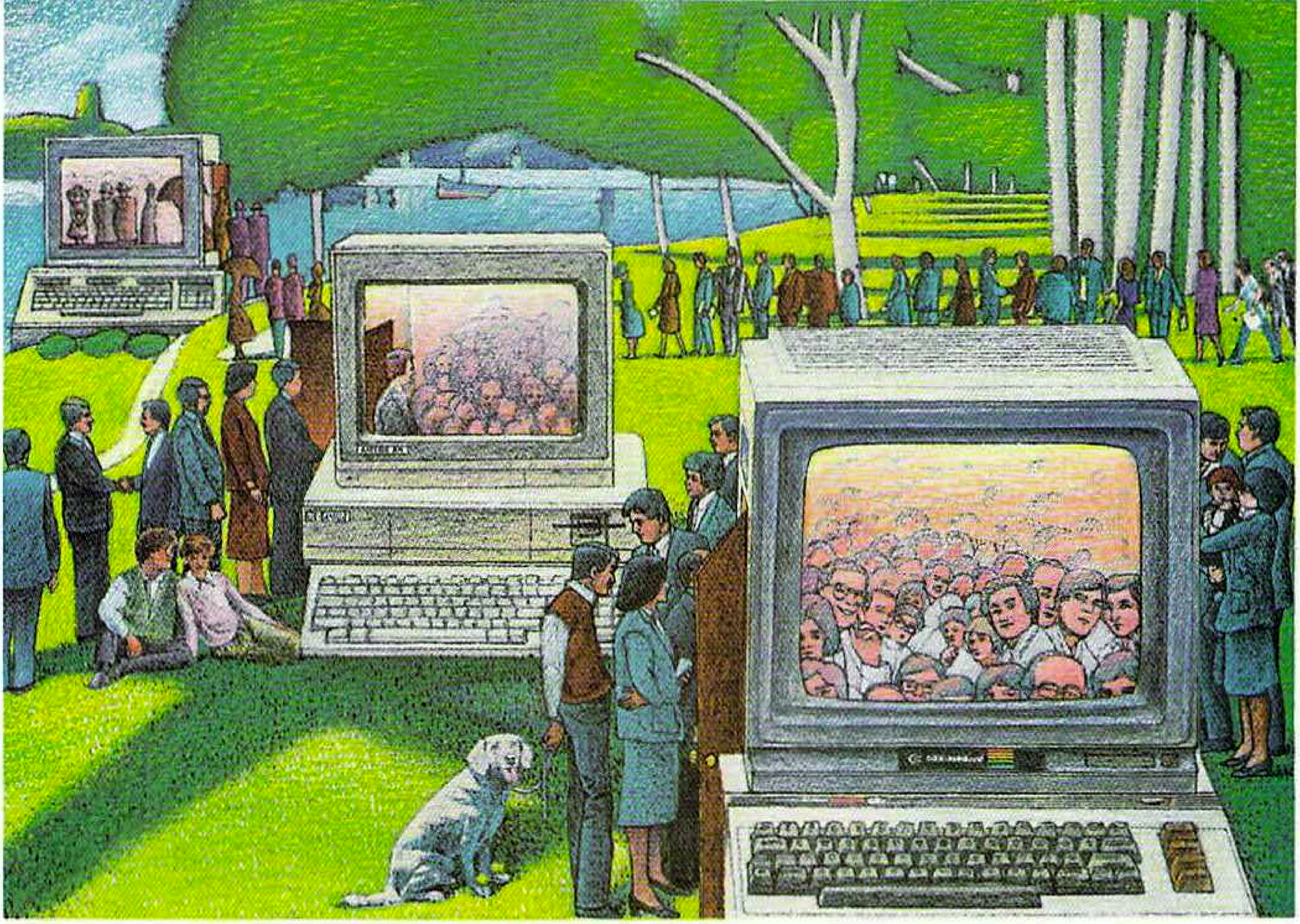
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Ahoy!

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Cover art by James Regan and Tom Cushwa; photo by Morton Kevelson

ISSUE NO. 33 SEPTEMBER 1986

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VIEW FROM THE BRIDGE

Do we love this time of year. As ad pages in *Ahoy!* increase with the approach of the holiday season, Mike Schneider increases editorial pages as well—making it possible to fit a whopping thirteen programs between our covers! If you still type our programs in, better get started. Otherwise you'll never finish by the time you receive October's issue—and who knows how many programs that will contain! If you're receiving our monthly disk, though, take time out to whet your appetite on the following description of this issue's contents:

• *Speech64* lets you synthesize speech without investing in a cartridge-based system—just a datasette and a cassette recorder. (Turn to page 39.)

• On *The LARC-1 Mission*, you'll dodge heat-seeking missiles while weaving your Low Altitude Reconnaissance Craft through radar placements, pylons, and walls. (Turn to page 17.)

• *Multi RAM* lets C-64 users access and use free RAM above 49152 for BASIC programs. (Turn to page 45.)

• If you've always wanted to be the heavy in a Little Rascals short, *Dogcatcher* is the next best thing. Bob Blackmer's latest game has you filling your truck with strays who try to treat you like Gainesburger. (Turn to page 60.)

• One of two C-128 utilities by R. Harold Droid, *Dual Dump 128* lets you print a display screen at any time. The second, *Variable Manager,* adds FIND and CHANGE commands to BASIC 7.0. (Turn to page 86.)

• While probing a *Mine Canyon* with four robot tanks, you'll have to maneuver through and around waves of mines that detonate upon contact. (Turn to page 18.)

• Cleveland M. Blakemore's *The Last Ninja* puts you in the garb of a shadow assassin armed with shurikens and opposed by a string of successively stronger opponents, ranging from sword-wielding evil ninjas to fire-breathing dragons. (Turn to page 85.)

• *Trapped* requires you to leapfrog around hostile aliens on your way out of an unknown galaxy. (Turn to page 56.)

Of course, our regular columnists wouldn't let a key-punching cornucopia like this go to press without contributing:

• In his *Rupert Report* on *Illustrious Graphics,* Dale Rupert facilitates onscreen placement of graphs and graphics with the C-128—along with providing programs enabling you to plot the graph of a function or a Moebius strip. (Turn to page 20.)

• Mark Andrews continues his *Commodore Roots* series on C-128 graphics with *Getting Up To Speed.* (Turn to page 27.)

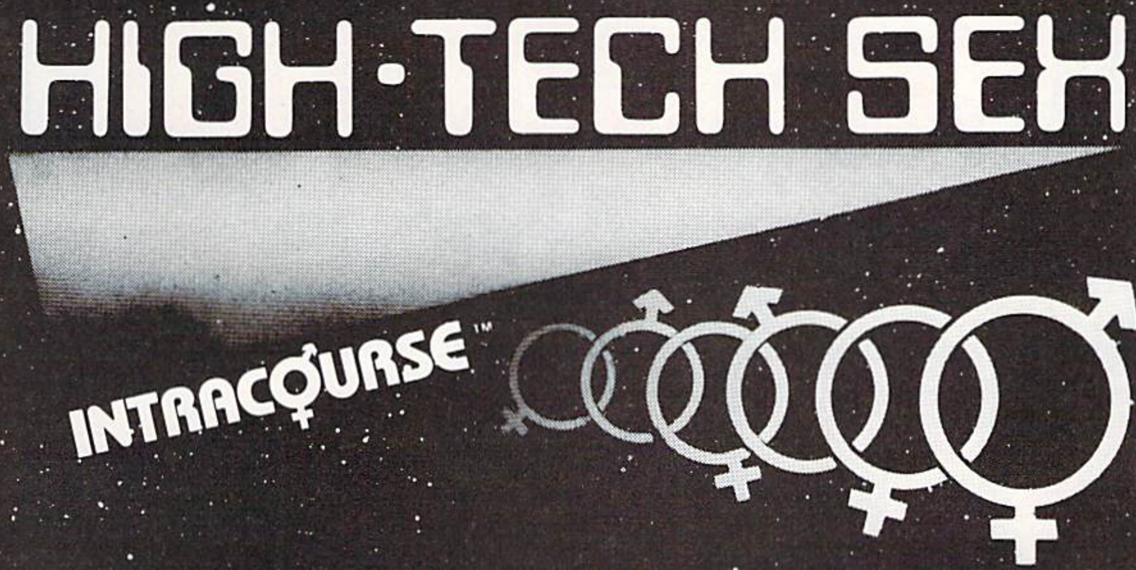
• Cheryl Peterson promotes beginners *From BASIC to COMAL* in this issue's *Cadet's Column.* (Turn to page 72.)

But we stopped short of turning this entire issue over to *Ahoy!* programs. Some pages are devoted to talking about other people's programs—as in our *Entertainment Software Section,* surveying numerous releases designed for *Making Music on the C-64.* Also provided is a more technical background on *The Sound of Entertainment*—plus full-length reviews of *Lords of Conquest, Alter Ego, Nam,* and *Bop 'n Wrestling.* (Turn to page 47.)

In our regular *Reviews* section is our long-awaited profile of the long-awaited Spartan. We're glad we held off until our evaluation unit arrived to bite into the apple used in the photos—we'd have gone through several dozen bushels by now. (Turn to page 63.)

Of special note is this month's *Scuttlebutt,* featuring prerelease information from June's CES. The Commodore market's healthy outlook should please you as much as us.

—David Allikas



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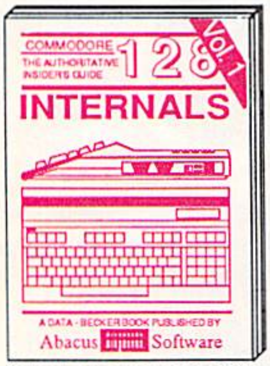
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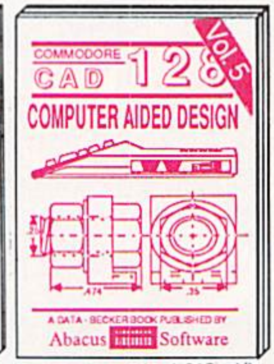
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COMPILER BOOK C-64/C-128 All you need to know about compilers: how they work; designing and writing your own; generating machine code. With working example compiler. 300pp $19.95

Adventure Gamewriter's Handbook Step-by-step guide to designing and writing your own adventure games. With automated adventure game generator. 200pp $14.95

PEEKS & POKES FOR THE C-64 Includes in-depth explanations of PEEK, POKE, USR, and other BASIC commands. Learn the "inside" tricks to get the most out of your '64. 200pp $14.95

Optional Diskettes for books For your convenience, the programs contained in each of our books are available on diskette to save you time entering them from your keyboard. Specify name of book when ordering. $14.95 each

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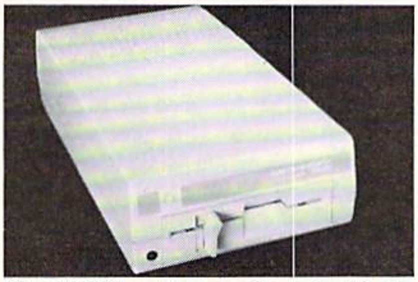
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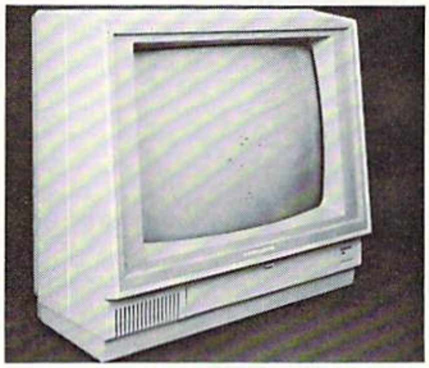
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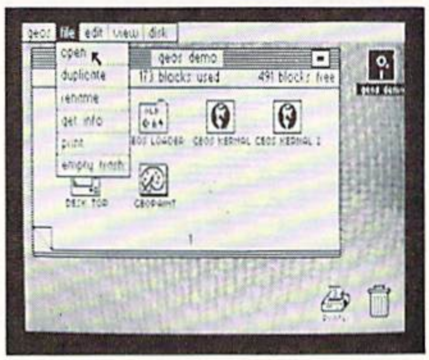
A familiar friend in a new box, the 64C comes with QuantumLink and GEOS *software. READER SERVICE NO. 264*



The 1541C is color-coordinated with the 64C (top) and 1802 monitor (right).



1802 monitor offers 40-column color and 80-column monochrome displays.



GEOS: *icon-driven operating system. READER SERVICE NO. 265*

CES A SUCCESS

Here's what Wall Street's been waiting for: our impressions of the June '86 Consumer Electronics Show, based on which the market will either rise or tumble. We're pleased to report that *Ahoy!'s* editors left this semiannual showcase of what's upcoming in the home electronics field with optimism. Our ailing segment of the marketplace—the home computer industry—had clearly rallied following its disastrous showing at January's CES, when few manufacturers had enough money, interest, or new releases to warrant exhibiting. While the number of companies renting space at June's show did not represent a staggering increase over January, we were relieved by the reappearance of many household names that were absent in Las Vegas. (Yes, one of them was Commodore—though their booth, a last-minute addition to the roster, was but a shadow of their traditional CES spectacle.) More important, the quantity of new releases was a sure sign of a patient on its way to recovery. Increasing support for the Amiga and Atari ST series helped add to the bulk, but the C-64 and C-128 were far from neglected—as the ensuing pages demonstrate.

In fact, fueled by sales of the 128 (600,000 claimed as of the show), the Commodore quadrant of the home computer marketplace may be poised for a leap forward. Even more significant in this regard may be the new 64C.

Sentimental sops that we are, we think the machine could be a mover. True, 64 sales peaked long ago—and the 64C is nothing but a 64 in a new casing, bundled with some software. But in this instance, repackaging will make a difference. The original 64 sold remarkably well when there were no alternatives in its price/performance category. But microcomputers today are prettier. An ugly clunker like the 64 would turn off the uneducated consumer. The 64C is as sleek and stylish as anything on the market, especially accompanied by its new, cosmetically matched 1541C disk drive and 1802 color monitor.

Still, earlier reports that Commodore would target the machine at pre-high schoolers made us skeptical. The machine's main selling point, after all, is the inclusion of the icon-driven GEOS operating system—a cinch to learn and use, but less likely to interest youngsters than their parents. But just consider how many millions of computer-shy adults would snap up an easy-to-use Macintosh if the price were right. If 10% of them go for the low-cost alternative of a 64C system, Commodore will have a bell-ringing Christmas. They'll even invite Jack Tramiel to the party.

Commodore Business Machines, 215-431-9100 (see address list, page 14).

THE TOY SHOP

The Toy Shop ($59.95) lets C-64 users make 20 working mechanical models and toys. Toys can be customized, printed out, and attached to adhesive cardboard. Wire, wooden dowels, cardboard, and other supplies are included.

Broderbund Software, 415-479-1170 (see address list, page 14).

C-64 TUTORIAL

The Professor ($34.97), a menu-driven self-tutorial for the C-64, teaches keyboard functions, BASIC, creation of music and custom sound effects, and advanced graphics, A quiz is found at the end of every lesson.

Progressive Peripherals & Software, Inc., 303-825-4144 (see address list, page 14).

AID FOR DISABLED

The *Access-Ability* keyboard emulator allows quadraplegic or manually disabled persons to operate a Commodore 64 by blowing into a mouthpiece that connects via a hose and special interface to the joystick port. The user follows standard Morse code to type the letters of the alphabet (e.g., a short puff followed by a long one = letter A), and assigned codes for the 64's special keys. Included are word processing, music, graphics, and game programs. Price is $69 plus $5 shipping.

Kingware Inc., 907-443-5603 (see address list, page 14).

LEDGER PROGRAM

Designed to help the home or small business user implement a general ledger system, *Bookkeeper-64* incorporates (and has the capacity to print) a chart of accounts, transaction register, and income statement. Included are two bonus programs: *List-64* (list processor for mailing lists, small databases, etc.), and *Biorhythm-64* (produces a biorhythm chart and list of critical days). $19.95 plus $2 shipping; CA residents add 6% sales tax.

Datacount Software, 619-460-6433 (see address list, page 14).

TOY SURPRISE INCLUDED?

Available under a different name for nearly a year in the northwest, *Kracker Jax* Volumes 1 and 2 ($19.95 each) are parameter copiers, each capable of duplicating a number of popular Commodore programs (Volume 1 lists 92 titles; Volume 2, 104). Additional updates, also $19.95, will be made available quarterly.

Kracker Jax Protection Busters, 206-696-4956 (see address list, page 14).

PD DISK

Several disks of public domain programs are available from Illini Software. Titles include *Best Games 1* and *2; Best Utilities; Best Home, Business, and Finance,* and *Best Fine Arts.* Prices are one disk for $14.95, two for $27, three for $37, four for $44, or all five for $49. Custom made disks are $19.95 each.

Illini Software, 312-355-1782 (see address list, page 14).

PRINTER NEWS

Okidata has added near letter quality capability to the Okidata 120 printer. NLQ text can be produced at a speed of 30 characters per second.

Additionally, a new Plug 'N Print interface kit renders the Okimate 20 color printer usable with the C-64 and C-128. Interfaces were previously available only for the Amiga and some non-Commodore computers.

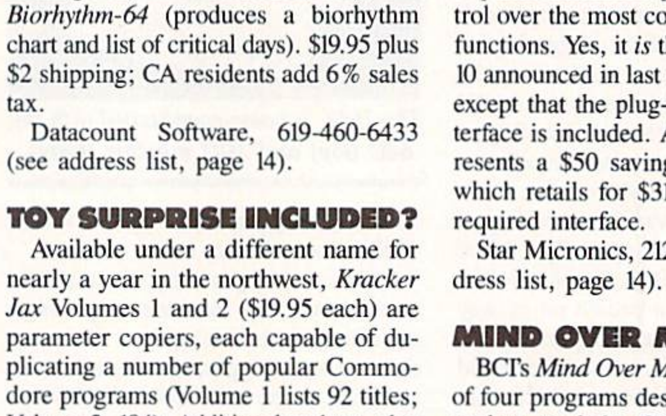
Okidata, 609-235-2600 (see address list, page 14).

Star Micronics' Commodore-specific Gemini II prints at 30 (NLQ mode) or 120 (draft mode) characters per second. A pushbutton front panel provides control over the most commonly used print functions. Yes, it *is* the same as the NL-10 announced in last month's *Scuttlebutt*, except that the plug-in Commodore interface is included. At $329 it thus represents a $50 savings over the NL-10, which retails for $319 plus $60 for the required interface.

Star Micronics, 212-986-6770 (see address list, page 14).

MIND OVER MATTER

BCI's *Mind Over Matter* series consists of four programs designed by a psychoanalyst to help C-64 users to *Lose Weight, Stop Smoking, Be Successful,* and *Conquer Stress.* The method used is subliminal suggestion:boot the title of your choice, then work with other programs while messages are flashed at a speed of 1/60 of a second—too fast to see, but slow enough for the mind to ab-



The Gemini II outputs at 30 cps in NLQ mode. Front panel contains common print functions. ***READER SERVICE NO. 252***

sorb. (If that sounds far-fetched, remember that the federal government long ago banned television advertising of that type.) The software will coexist with a number of popular programs without causing interference. Price is $9.95 each.

BCI Software, 201-835-7300 (see address list, page 14).

MIND OVER KANSAS

We'd be a little leery about linking our name with software designed by 60's drug guru Timothy Leary. Unless, of course, there was money in it. Electronic Arts must feel there is, because they've published Dr. Leary's *Mind Mirror* for the C-64. The "mental awareness" program, based on Dr. Leary's earlier (pre-LSD) work designing interactive personality tests and humanistic psychotherapies, allows the user to examine the stereotypes that shape his mind by rating a subject (or stereotype) on a series of seven point scales. Results are summarized in the form of a Mind Map. You may then play Life Simulations, which presents you with a series of situations and asks you to respond to each one through the eyes of your subject. Price is $34.95.

Electronic Arts, 415-571-7171 (see address list, page 14).

LET US INTERFACE

Two tomes from Howard W. Sams: *Modem Connections Bible* ($16.95) offers guidance to the individual planning to connect a modem, interconnect several modems, or buy a modem. Included are numerous drawings of the RS-232C interfaces on a number of computers.

Printer Connections Bible ($16.95) focuses on the hardware side of connecting printers and computers, particularly interface cables. Tables and diagrams are provided, as well as information about various printers, computers, and software.

Howard W. Sams & Co., 317-298-5723 (see address list, page 14).

TIMEWORKS A-CHANGIN'

Timeworks has enhanced four of its $69.95 C-128 productivity packages, as follows:

Word Writer 128 will now work with either a 40- or 80-column monitor. Also added was an integrated thesaurus that utilizes the program's 85,000 word spell-checking diction- ary.

Swiftcalc 128 with *Sideways* now includes hi-res, 3-D graphics, multilevel sorting, Swiftkeys (convert multikey commands to one keystroke), and Swift-DOS (access disk commands while spreadsheet is in memory).

Data Manager 128 with *Report Writer* features improved editing keys, additional windows, and faster and easier record browsing.

Sylvia Porter's Personal Financial Planner 128 has been given improved help screens and report features, automatic check incrementing, and sorting and deleting capabilities in the Asset/Liability Manager section.

Timeworks, 312-948-9200 (see address list, page 14).

SYLVIA'S SECOND

Scheduled for late summer release, *Your Personal Financial Planner* ($69.95), the second volume in Sylvia Porter's Personal Finance Series for the C-128, will manage investment transactions, track portfolios, provide strategies, monitor taxes, and alert the user to investment deadlines. Telecommunications access to Dow Jones,CompuServe, The Source, and other databases is provided.

Timeworks, 312-948-9200 (see address list, page 14).



Emphasis is on hardware connections.
READER SERVICE NO. 253

TELECOM NEWS

The all-Commodore QuantumLink BBS has announced plans for adding four new services:

American Airlines Eaasy Sabre (the double 'a' is for American Airlines) will let subscribers check flight schedules and fares on over 300 airlines, as well as reserve hotel rooms, rent cars, and check weather reports.

A multiplayer game codeveloped by Lucasfilm Ltd. and tentatively titled *Habitat*, which will run on the computers of individual players via special software.

The *Reuters News Service*, providing updates every 10 minutes, on national, international, and business developments.

The Resource Center, providing teachers, administrators, and parents with information about using Commodore computers via its four sections: The Library (curriculum guides, teaching strategies, and more), The Media Room (teacher-written software programs), The Lounge (a meeting place for discussion), and Message Boards.

Quantum Computer Services, Inc., 703-448-8700 (see address list, page 14).

The C-128 upgrade of the *Dial-Your-Match* BBS software ($99.95) allows callers to add comments to public messages, browse other callers' answers, and send private mail. The SYSOP can define multiple public message boards and information files, dial in remotely, and assign multiple SYSOPs via the flexible user-level system. A 72-page manual is included.

Matchmaker Enterprises, 818-840-8066 via modem or 818-840-8211 (see address list, page 14).

INTERFACE

The 92008/G ($59) connects a Centronics printer to a C-64 or C-128 and prints all Commodore special characters, block graphics, single point graphics, etc. An 8K buffer is included.

BlueBox Interfaces (see address list, page 14).

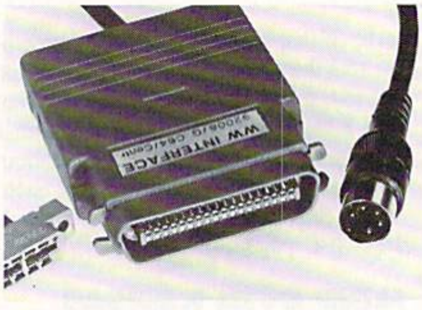
512K AMIGA EXPANDER

Boasting the smallest footprint of any external memory yet available for the Amiga, Alegra will add 512K, while its use of semi-custom logic and a printed circuit design will allow for future expansion to 2 megabytes. Power for the unit (less than 5 watts) is supplied by the Amiga at the expansion connector.

Access Associates, 408-727-0256 (see address list, page 14).

EDUCATIONAL SOFTWARE

Facemaker: Golden Edition ($49.95), an Amiga conversion of Spinnaker's program that lets children create funny faces while learning computer fundamentals, features a new menu of options including faces, body types, and accessories such as eyeglasses and earrings, plus new sound effects. A simple word processing capability lets kids type a name or short message next to their creation.



92008/G Interface has 8K buffer.
READER SERVICE NO. 254

Spinnaker is offering an unconditional 30-day money back guarantee on its four Storytime titles: *Peter Rabbit Reading, Prokofiev's Peter and the Wolf Music, The First Men on the Moon Math,* and *Jungle Book Reading* (for the 64; $24.95 each).

For those who follow the corporate side of things, Spinnaker has also announced the acquisition of Hayden Software.

Spinnaker Software, 617-494-1200 (see address list, page 14).

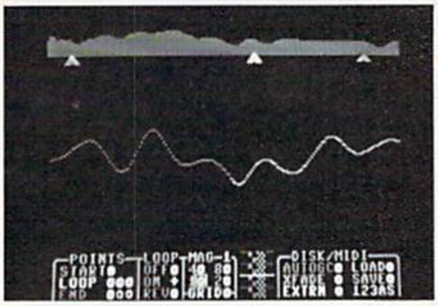
ShareData's line of Electric Books places words and illustrations of children's stories on the C-64 screen exactly as they appear in books, along with ten different activities on each disk "page," such as scrambled words, connect-the-dots, rhyming words, and more. The 20 titles currently available, ranging from classics like *Tom Thumb* and *The Little Mermaid* to current bestsellers like *Roger's Umbrella* and *I Was a Second Grade Werewolf*, are priced at under $10 for a disk containing two complete books.

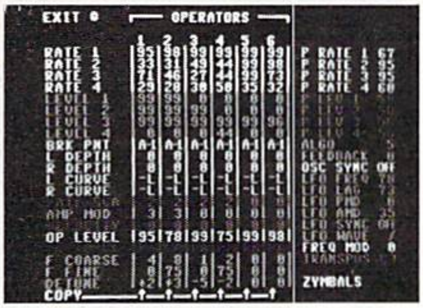
ShareData, Inc., 800-329-6061 or 612-829-0409 (see address list, page 14).

Lord of the Flies is the first installment in CBS's *Novel Approach* series for grades 7-12, to be followed in the fall by *Animal Farm, A Tale of Two Cities, The Call of the Wild,* and *Romeo and Juliet.* Each of the C-64 programs includes three learning activities: *The Discoverer* (to pique interest before reading), *The Explorer* (a self-paced series of questions and answers to enhance understanding), and *The Master* (to test students' knowledge of the story after reading it). A program guide, teacher's guide, and back-up disk are included. Price is $59.95 (Lab Pack, $179.85).

CBS Interactive Learning, 203-622-2500 (see address list, page 14).

MasterType's Writer ($44.95) is a word processing program containing special features to improve writing skills, including dual windows (for outlining in one and writing in the other), color highlight-





New MIDI products for C-64 musicians who own a Yamaha DX-7 synthesizer or Akai S-612 sampler. *READER SERVICE NO. 255*

ing of text, and sorting. Built-in macro commands allow assignment of frequently used phrases to a single-key. Multiple typefaces can be selected and seen onscreen, including script, large print, and small print. Help screens are available, and the flip side of the disk includes a tutorial.

Scarborough Systems, 914-332-4545 (see address list, page 14).

Three classroom-oriented releases from Gamco, each $39.95 for one C- 64 disk, $54.95 with backup, or $164.95 for class pack or network version:

Math Football: Whole Numbers and *Math Football: Decimals* can be played at four levels: High School (addition and subtraction), College (multiplication), Pro (division), or Super Bowl (mixed operations). Players may choose a running play (easy problem), short pass (medium problem), long pass (hard problem), or punt. The program management system allows teachers to adjust playing time, set time limits for answering problems, and turn sound on or off.

Blackout! provides drilling in the rules of capitalization, putting the student in the role of an electrician trying to put a city's lights back on. Each time he correctly capitalizes a word, a connection is made.

Both programs allow the teacher to hold 200 student files in alphabetical order, and view, print, or delete individual files.

Gamco Industries, Inc., 800-351-1404; in TX call collect 915-267-6327 (see address list, page 14).

MIDI PRODUCTS

Two MIDI software products from Ultimate Media:

AutoPilot ($49.95) lets DX-7 users automatically create instant sound patches and edit and save them using the C-64. Also included are joystick-controlled visual graphic sound patch editor and disk librarian functions. Files containing from 1 to 32 DX-7 sounds can be stored.

SampleScope ($149.95) allows owners of the Akai S-612 to visually edit samples using a C-64 with a precision 256 times greater than with the S-612's manual mode.

In addition to the equipment mentioned, use of either program requires a MIDI adapter (Sequential Circuits Model 242 or Passport Model C-64), two MIDI cables, and a joystick.

Ultimate Media, 800-334-CHIP; in CA 800-228-6244 or 415-924-3644 (see address list, page 14).

CERTIFICATE MAKER

Certificate Maker ($49.95) offers the C-64 user a choice of 200 certificates in the categories of sports, business, recreation, religious, home, scholastic, and more, which he may fill in with one of 16 border designs and a message of his choice in a variety of type sizes and styles. Three dozen seals and stickers are included as well. Certificates can be printed out on any popular printer, one at a time or by list.

Springboard Software, Inc., 612- 944-3915 (see address list, page 14).



200+ certificates of assorted types. *READER SERVICE NO. 256*

NEWS

DYNACOMP CATALOG

A new 192-page software catalog (#30) has been published by Dynacomp, over 90% of the titles listed published exclusively by them. A free copy is available upon written request.

Dynacomp, Inc., 716-671-6160 or 6167 (see address list, page 14).

POLAR PRICE CAPS MELT

Polarware has lowered prices on all its software. The *COMPREHEND* Interactive Novel Series, including *Crimson Crown, The Coveted Mirror, Transylvania,* and the new *Oo-Topos* (see **GAME RELEASES**), will sell for $17.95 each, as will the fantasy role-playing games *Xyphus* and *Sword of Kadash; Graphics Magician Junior* for $19.95; and several older games for $8.95 and $12.95 each.

Polarware, 800-323-0884 or 312-232-1984 (see address list, page 14).

WALT DISNEY PROGRAMS

Bantam has developed two children's productivity programs utilizing the Walt Disney menagerie:

Walt Disney Comic Strip Maker lets designers seven years old and up design and write their own strips, choosing among the 180 hi-res color graphics provided, plus assorted objects and backgrounds, all of which can be transposed, cropped, and mixed and matched. Balloons can be filled in with original or preprogrammed phrases. Strips can be printed in color or black and white.



New Bamtam software lets kids of all ages create Disneyized party goods and comic strips on a 64 and printer. ***READER SERVICE NO. 266***



Walt Disney Card & Party Shop supplies over 45 designs and over 100 graphics of characters and objects for creating stationery, greeting cards, and party goods like invitations, place cards, and wrapping paper. Three preprogrammed party sets will print out everything for an Alice in Wonderland, Winnie the Pooh, or Mickey and friends party theme.

Each $39.95 C-64 program includes an art tool box for sizing, transposing, and cropping characters, plus a built-in word processor.

Bantam Electronic Publishing, 212-765-6500 (see address list, page 14).

GAME RELEASES

Based on *Wizard* and *Wizard Expansion Set, Ultimate Wizard* ($29.95) for the C-64 plunks the player down in over 100 levels of dungeon playfields that require strategy and reflexes to navigate. The goal is to collect treasures and keys that provide transport to higher levels, collecting magical potions along the way for casting spells against a large assortment of creatures and other enemies. The construction set can be used even by those inexperienced with game design. Up to six may play at a time.

Electronic Arts, 415-571-7171 (see address list, page 14).

Cosmi has upgraded its *Super Huey* helicopter flight simulator for the Amiga, utilizing that computer's superior graphics, memory, and sound capabilities. Price is $39.95.

Cosmi, 213-835-9687 (see address list, page 14).

The newest in Polarware's series of COMPREHEND Interactive Novels, *Oo-Topos* ($17.95) requires you to deliver to earth the chemical seeds of a compound that will protect the planet against deadly power transfusion waste. The job is complicated by alien space pirates who have seized your ship and thrown you in prison, from which you must escape before time runs out for earth.

Polarware, 800-323-0884 or 312-232-1984 (see address list, page 14).

Gettysburg: The Turning Point ($59.95) lets players engage in the entire three day battle from July 1-3, 1863, or play any one of the three days separately. Geography, munitions, and morale of the soldiers are among the elements that can affect the outcome of a tactical plan. Both generals may track artillery, men, and ammunition separately for each brigade unit. For the C-64.

Strategic Simulations Inc., 415-964-

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1353 (see address list, page 14).

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Accolade, Inc., 408-446-5757 (see address list, page 14).

Underwurlde/Sabre Wulf, Firebird's latest Super Silver Disk (two games for $19.95–both spelled strangely), offers caverns, labyrinths, harpies, gargoyles, poisonous plants, and volcanoes in the case of the former and glades, ravines, hollows, jungles, and a mystic amulet in the case of the latter.

Firebird Licensees, Inc., 201-934-7373 (see address list, page 14).

Mindscape's Cinemaware line of interactive "movies" for the Amiga with 512K are designed as role-playing games, with the player's onscreen character changing and adapting each time the game is played. The programs are designed to simulate an actual movie experience, with closeups, zooms, pans, and changes in perspective. Each game features a nonlinear plot with a minimum of hard branches.

The King of Chicago sends the player up against the Capone mob in a struggle for control of that toddlin' town. Characters, settings, events, and other elements alter themselves depending on the player's actions. Assassination attempts,

Continued on page 76

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491 Aldo Avenue
Santa Clara, CA 95054
Phone: 408-727-0256

Access Software, Inc.
2561 South 1560 West
Woods Cross, UT 84087
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6925 Rosemead Blvd. #24
San Gabriel, CA 91775

Broderbund Software
17 Paul Drive
San Rafael, CA 94903

CBS Interactive Learning
One Fawcett Place
Greenwich, CT 06836
Phone: 203-622-2500

Commodore Int'l
1200 Wilson Drive
West Chester, PA 19380
Phone: 215-431-9100

Cosmi
415 North Figueroa Street
Wilmington, CA 90744
Phone: 213-835-9687

Datacount Software
P.O. Box 1679
Coronado, CA 92118
Phone: 619-460-6433

Dynacomp, Inc.
P.O. Box 18129
Rochester, NY 14618
Phone: 716-671-6160, 6167

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1820 Gateway Drive
San Mateo, CA 94404
Phone: 415-571-7171

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Sunnyvale, CA 94089
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Phone: 206-696-4956

Matchmaker Enterprises
P.O. Box 6055
Burbank, CA 91510
Phone: 818-840-8066 via modem or 818-840-8211

Mindscape, Inc.
3444 Dundee Rd.
Northbrook, IL 60062
Phone: 800-221-9884 in US; in IL 800-942-7315; elsewhere 312-480-7667

Okidata
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Phone: 609-235-2600

Polarware
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Progressive Peripherals & Software
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Denver, CO 80204
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Quantum Computer Services Inc.
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Tarrytown, NY 10591
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ShareData Inc.
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Eden Prairie, MN 55344
Phone: 800-328-6061 or 612-829-0409

Spinnaker Software
One Kendall Square
Cambridge, MA 02139
Phone: 617-494-1200

Springboard Software
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Minneapolis, MN 55435
Phone: 612-944-3915

Star Micronics Inc.
200 Park Ave., Ste. 3510
New York, NY 10166
Phone: 212-986-6770

Strategic Simulations
1046 N. Rengstorff Ave.
Mountain View, CA 94043
Phone: 415-964-1353

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444 Lake Cook Road
Deerfield, IL 60015
Phone: 312-948-9200

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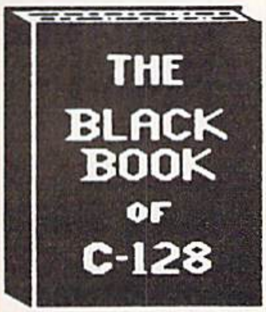
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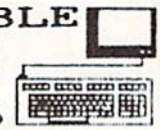


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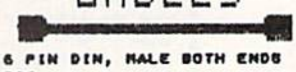
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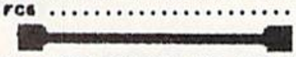
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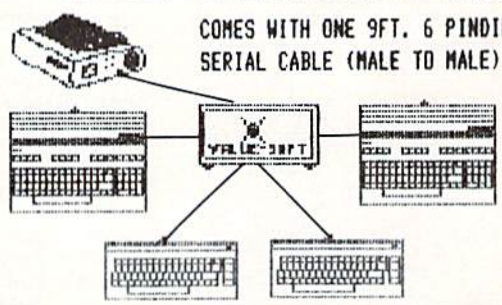
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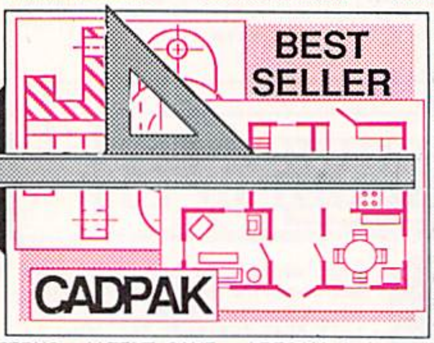
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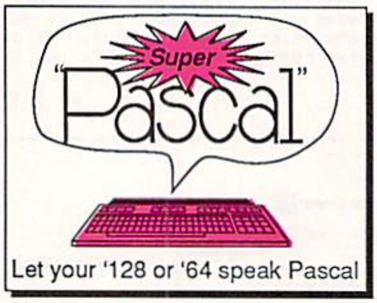
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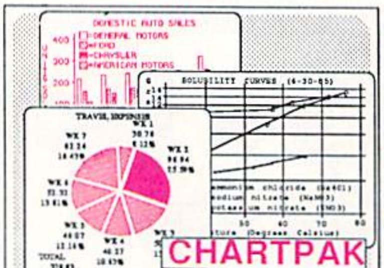
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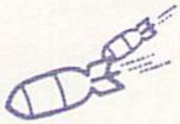
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Reader Service No. 217

THE LARC-1 MISSION





For the C-64



By Joseph Bedard

As a pilot, you've heard of all the dangers of reconnaisance missions: radar defense systems, land-based barriers, and worst of all, missiles. Although regular missiles are trouble enough for reconnaisance pilots, heat-seeking missiles are their greatest problem.

All this talk never meant anything to you until you were picked to lead a reconnaisance mission through enemy territory. The code name for the mission is LARC-1. You'll be flying the government's experimental L.A.R.C. prototype (for Low Altitude Reconnaisance Craft). The terrain you'll be flying over is covered with radar placements, pylons, and walls. Walls have large holes which your craft can pass through. There are also heat-seeking missiles that home in on the heat from your ship's exhaust. The only way to stop a heat-seeker is to cause it to collide with an obstacle.

Movement of your craft is controlled by one joystick (plugged into Port 2) and limited to forward, backward, left, and right; no diagonal movement is possible. Your craft is at a fixed altitude, so you cannot fly over any obstacles. The fire button is not used in this game.

There are three levels to choose from. On level one (the easiest), the ground moves slowly, giving the obstacles longer screen time, and walls seldom appear. On each higher level the ground moves faster and the walls appear more often. ☐

SEE PROGRAM LISTING ON PAGE 93

MINE CANYON

For the C-64

By John Krutch

The war between the Imperium and the Federation has dragged on for years now. As an officer with the Federation's military intelligence division, you are in command of four robot tanks which you control from a plane above. Deep in enemy territory, your mission is to use the tanks to explore and map the area.

While mapping a narrow canyon, you are taken by surprise by an enemy task force. Designed specifically to combat robot tanks, the task force consists of waves of mines which detonate instantly upon contact. Furthermore, low-flying enemy planes which move methodically back and forth across the canyon will bomb any tank they happen to fly over.

Your task in *Mine Canyon* is to keep your tanks alive as long as possible by steering them through the gaps in the rows of mines (the gaps mark the place where a mine had been before it was detonated). Maneuvering your tanks through the mines is not an easy job, since any contact with a mine will cause your tank to explode. An enemy plane flying above the tank will have the same effect.

Mine Canyon is a machine language program for the Commodore 64. You must use *Flankspeed* (see page 89) to enter it into your computer's memory and save a copy to disk or tape. When you've finished typing in the program and have saved a completed copy, use LOAD "FILENAME",8,1 to load the program from disk or LOAD "FILENAME",1,1 to load the program from tape. Once the program has loaded, type SYS 49152 to start it.

To play *Mine Canyon*, a joystick must be plugged into Port 2. When you've started the game, you'll notice that the view of the canyon is from above. You can move your tank north, south, east, or west. When your current tank is destroyed by a mine or plane, your next tank will come into play, until all four tanks are gone.

You score 10 points each time a new row of mines moves into view. When all your tanks have been destroyed, the final screen which contains your score will appear. Theoretically, the score can go as high as 99990 before turning over, but this is optimistic to say the least; you're doing well if you can score 2000 points. When the final screen appears, you can play another game by pressing the joystick button or quit by pressing the STOP key.

There are two ways to maximize your score while playing *Mine Canyon*. The first and most obvious way is to avoid moving your tank to the extreme north or south of the canyon (top or bottom of the screen) when possible. You can also maximize your score by biding your time. Wait until the enemy plane is almost on top of the tank, then quickly scoot the tank around the plane, if you can, and through the row of mines. □

SEE PROGRAM LISTING ON PAGE 101

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RUPERT REPORT



The graphics tools on the Commodore 128 encourage sophisticated exploration. Drawing straight-edge figures on the screen is relatively easy with the DRAW command. Combining text and graphics is cumbersome but not difficult with the CHAR command. What more could we want? Two things: viewports and windows.

These are essential parts of every graphics toolbox. Viewports specify where on the screen to place the image. Windows allow the image to be scaled up or down within the viewport.

The Moebius (or Möbius) strip is merely a topological curiosity which we will use as an interesting figure to illustrate the effects of viewports and windows.

(As an aside, you can contruct a Moebius strip from a long, narrow strip of paper. Tape or glue its ends together, but give one end a half twist before doing so. You now have a single-sided object, believe it or not. If you are skeptical, try painting one side one color and the other side another color. One color is all it takes! Another surprising property of this seemingly simple loop is that you may cut it lengthwise down the middle and still end up with one loop, not two.)

Moebius strips are not really our concern. We are interested in the enhanced capabilities provided by viewports and windows. We saw last month that only certain functions could be readily graphed. The graphs of most functions are too large or small to fit nicely on the screen.

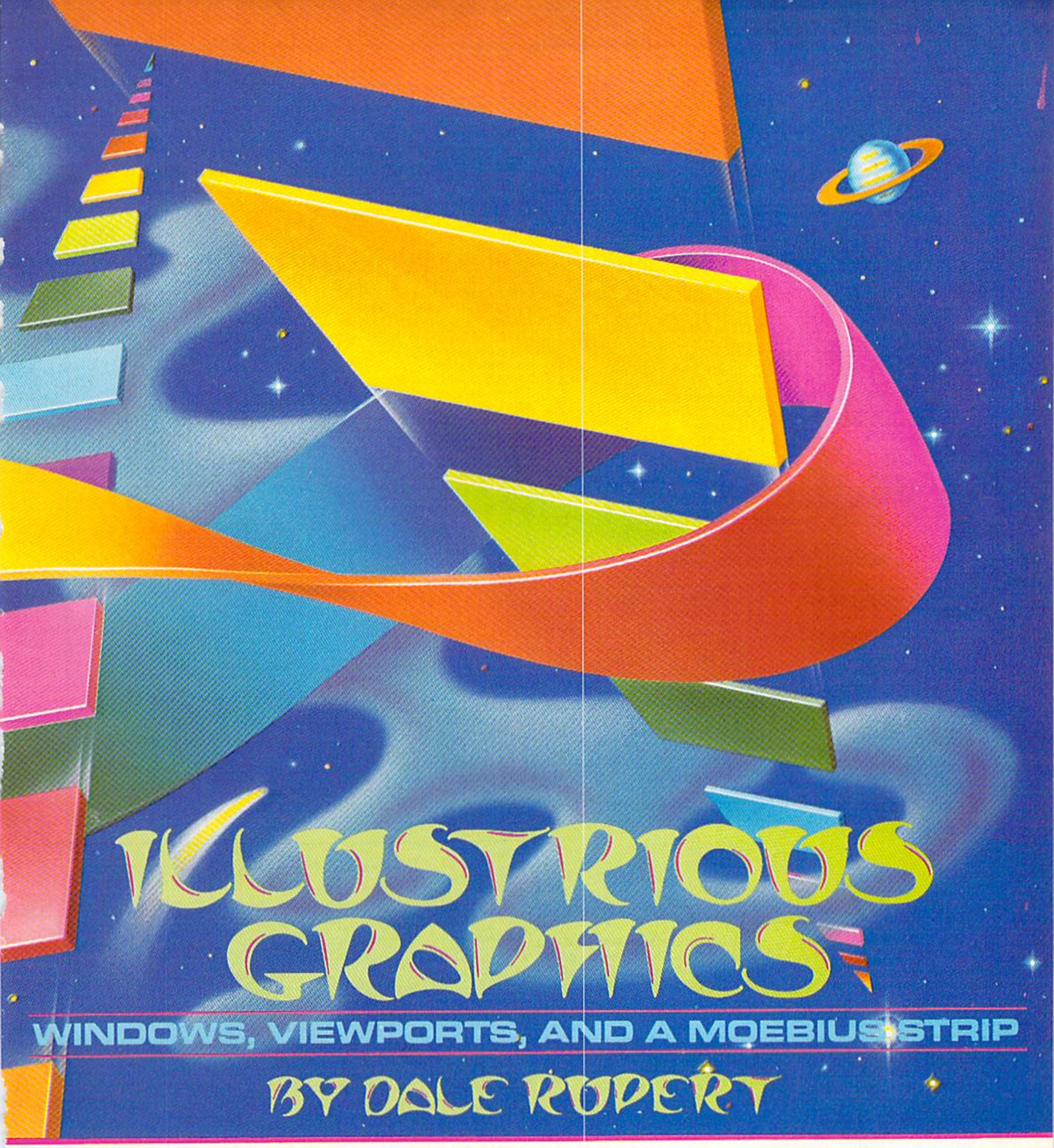
A standard solution to this problem is to perform a windowing transformation of the points on the graph before displaying them. Here is an important note before we begin: The windows we will discuss are not to be confused with the BASIC 7.0 WINDOW command, which actually deals with a text viewport. Think of the window as the sheet of graph paper on which the original function is plotted. The size of the paper and the scales on the axes determine the size of the graph.

For example, consider drawing a 2 mile by 2 mile square to scale on graph paper. Assume the sheet of graph paper has 100 horizontal lines and 100 vertical lines. If you assign a scale such that one line (or grid) equals one mile, the graph will be a tiny square two units on a side. If you decide that every ten grid lines represents one mile, now the graph will be a square twenty units on a side and will fill more of the paper. Change the scale so that fifty grid lines equals one mile, and the graph of the square completely fills the paper.

With the windowing transformation, we can specify the number of units horizontally and vertically on the graph paper. If we say that the entire graph paper is four units wide and two units tall, the two-by-two square fills the paper vertically and is half its width.

WORLD COORDINATES

We use the "world coordinate system" to specify the size of the window. World coordinates are to be distinguished from "screen coordinates" which we will discuss later. Let's assign to the left and right sides of the window the values 0 and 4, and to the bottom and top we give 0 and 2. The four corners of this window have coordinates (0,0), (0,2), (4,2), and (4,0), starting at the lower



ILLUSTRIOUS GRAPHICS

WINDOWS, VIEWPORTS, AND A MOEBIUS STRIP

BY DALE RUPERT

left corner and moving clockwise. The first value of each coordinate pair represents the horizontal location, and the second value of the pair indicates the vertical location. The window and the coordinates of its corners are represented in Figure 1 (see page 24).

Now we may draw the graph of a two-by-two square in this window. If the lower left corner of the two-by-two square is at coordinate (0,0), the graph of the square will fill the left half of the window. If we change the coordinates of the window so its lower left corner is (−2,0) and its upper right corner is (2,2), the two-by-two square starting at (0,0) fills the right half of the window.

Now redefine the window so that it goes from −4 to 4 horizontally and from −2 to 2 vertically. The two-by-two square starting at (0,0) is represented in Figure 2 (see page 24).

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By changing the height and width of the window, we can change the relative size of the square in the window, and we can change its position. The square fills the window when the window is small. As the window becomes larger, the square fills less and appears smaller.

It is possible for the window to cover a range of world coordinates such that the two-by-two square at (0,0) would not even be visible (from 5 to 10 horizontally and from 5 to 10 vertically, for example).

In summary, the object we are graphing is located at certain world coordinates. The window we specify covers some portion of the world coordinates. The relative size and location of the object in the window depend upon the size and location of the window through which we are viewing it. An object appears relatively small in a large window and relatively large in a small window.

OUR PORT OF VIEW

In the Amiga, MacIntosh, and IBM worlds, the concept of "window software" is certainly in fashion. What are commonly called "windows," we will refer to as "viewports." Our discussion is based upon the widely accepted graphics standards and terminology presented in *Principles of Interactive Computer Graphics* (Newman and Sproull, McGraw-Hill, 2nd Edition, 1979).

A viewport is a rectangular portion of the screen in which the contents of the window will be displayed. We refer to the coordinates of the viewport as the "screen coordinates" because they represent physical locations (measured in pixels) on the screen. Consequently the maximum viewport size for the C-128 in standard high resolution mode is 320 horizontally by 200 vertically, since those are the maximum numbers of pixels (addressable points) on the screen.

Let's go back to our last two-by-two square example. The window ranged from −4 to +4 horizontally and from −2 to +2 vertically. The point (0,0) is in the center of the window, and that is the lower left corner of the two-by-two square. Refer to Figure 1 again.

We want to translate every point within this window to a corresponding point within a viewport on the screen. The four corners of the window all coincide with the four corners of the viewport. All other points in the window will be proportionately placed in the viewport.

We use a different set of physical coordinates than those usually associated with BASIC 7.0 graphics. Our viewport coordinate system assumes that (0,0) is in the lower left corner of the screen and that (320,200) is in the upper right corner. This allows the screen to be represented using the standard Cartesian coordinate system. Up and right are positive; down and left are negative. This is also consistent with the world coordinate system we have just discussed.

Assume that the viewport goes from 10 to 200 horizontally and from 20 to 150 vertically. If we match the four corners of the window to the corners of this viewport, the image of the viewport and the two-by-two square resembles Figure 3 (see next page).

The screen is the outer rectangle, and the coordinates of its corners are shown in square brackets. The window completely fills the viewport which is the rectangle within the screen boundaries. The screen coordinates of the viewport's corners are shown in parentheses. The two-by-two square has the same relative position within the viewport as it has in the window.

The use of two separate coordinate systems, world coordinates and screen coordinates, provides several advantages over a single coordinate system. We have seen that the relative size and location of the object being drawn or plotted is easily changed by merely changing the coordinates of the window. The actual size and location of the object displayed on the screen is determined by simply defining the coordinates of the viewport.

Straightforward formulas convert the world coordinates of any object into the proper pixels on the screen. Look at the program *Moebius Plotter* on page 92. (The program draws a Moebius strip with three half-twists. Feel free to explore its properties on your own.)

Although the program is written for the C-128, the concepts and formulas are usable on any computer. Other computers must provide routines for drawing a line between two points and for lighting or moving to any given point. The program is written in a modular format

so that it is easily understandable and adaptable.

Line 10 saves the current screen mode. Line 130 restores that mode when the program is finished. The high resolution graphics screen is specified and cleared by line 20. The initialization subroutine beginning at line 500 uses the specified window and viewport coordinates to calculate conversion constants A, B, C, and D beginning at line 650.

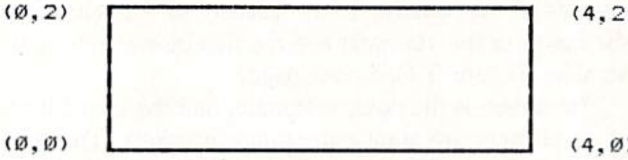


Figure 1: World Coordinates

The world coordinates of the window are stored in WL, WR, WT, and WB starting at line 520. These correspond to the left, right, top, and bottom values of the window. The screen coordinates for the viewport are given by VL, VR, VT, and VB starting at line 590, also corresponding to left, right, top, and bottom.

Remember that VL and VR must be between 0 and 320 (0 and 160 for multicolor graphics), and that VT and VB must be between 0 and 200 since those are the pixel limits on the high resolution screen. Remember also that both coordinate systems assume that up and right are positive directions while down and left are negative. The point (0,0) is assumed to be in the lower left corner of the screen.

Line 700 draws a box on the screen to represent the location of the viewport. Notice that all Y-values to be drawn or referenced must first be subtracted from 200. This allows the screen to use "normal" coordinates with 0 at the bottom and 200 at the top.

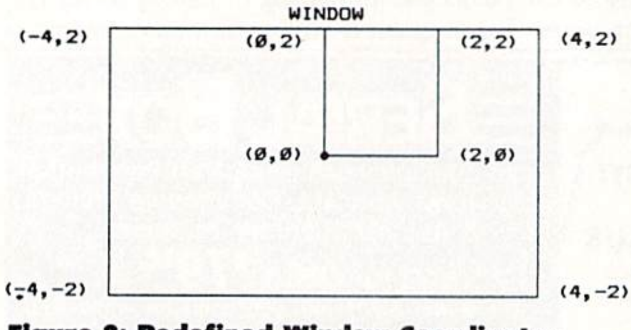


Figure 2: Redefined Window Coordinates

The next subroutine called by the main program begins at line 1000. The X,Y pairs of coordinates for the Moebius strip are in DATA statements beginning at line 1100. If the X coordinate is negative, this program assumes that the graphics cursor should move to that point rather than connect it with a line to the previous point. The values of 1E29 in line 1140 tell the program that the last point of the figure has been accessed.

The variable MV is returned to the main program to show whether to quit (MV=1), move to the current point (MV=2), or draw a line to the current point (MV=3). Before any points can be plotted, they must be converted from their world coordinate values to screen coordinates. The subroutine at line 2000 which is called by line 50 performs the conversion.

The scale factors are applied to the X and Y coordinates in lines 2010 and 2020, giving screen coordinates XS and YS. Before these points are plotted, the subroutine at line 3000 is called to eliminate any points which are outside the range of the viewport. The C-128 is very unforgiving if asked to plot a point which is off the screen.

Line 80 flips the YS coordinates upside down to match the physical screen coordinate system. The subroutine at 4000 or 5000 is called to move to the point (XP,YP) or to draw a line from the previous point to that point. The main program loop is repeated from line 40 until all points have been used. Finally line 120 paints one side of the figure, and line 130 restores the original screen mode. If you use a single screen for text and graphics, you might add this statement:

```
125 GETKEY A$
```

This will retain the graphics screen until you press any key to return to the text screen.

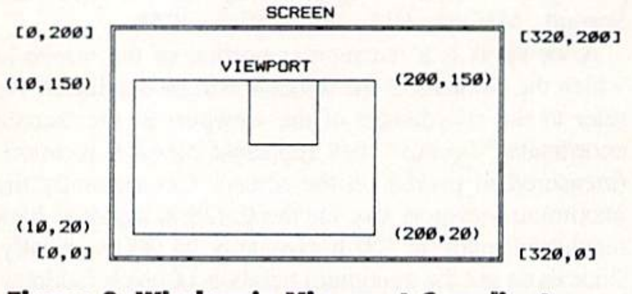


Figure 3: Window in Viewport Coordinates

Notice the use of RDOT in line 120. Although all graphics commands should allow negative relative coordinates (according to the *C-128 System Guide*), my machine does not accept them. For example, PAINT 1,−2, +3 should start painting at a point which is 2 units to the left and 3 units below the previously accessed point. Unfortunately, my C-128 gives an ?Illegal Quantity Error message for the negative value.

The RDOT function easily overcomes the problem. RDOT(0) and RDOT(1) represent the last X and Y coordinates referenced. It is a simple matter to add to or subtract from the RDOT values to create relative moves as line 120 shows. The statement PAINT 1,RDOT(0)−2, RDOT(1) is equivalent to PAINT 1,−2,+0. That is, move horizontally two pixels to the left to begin painting.

To better appreciate the power of the these graphics tools, experiment with different values for the window and for the viewport. As a start, run the program as listed. Next change the values in lines 590 through 620 to 125, 185, 140, and 100 respectively. Then type RUN 30. The original image remains on the screen if we skip line 20. Now the viewport is much smaller than the original one. Note that the new image is smaller but still centered within the viewport just as the original is.

Change the viewport coordinates once more to 148, 158, 130, and 122 respectively and type RUN 30. Clearly we don't have to worry about changing the coordinates of the object we are drawing. The windowing transformation takes care of everything.

To make the object fill up more or less of the viewport, regardless of the viewport's size, change the window size in lines 520 through 550. A larger window causes the relative size of the object to be smaller. Change values in lines 520 through 550 to 0, 40, 40, 0 and change values in lines 590 through 620 to 0, 100, 200, 0 respectively. Then type RUN. The image will be distorted vertically or horizontally if the shape of the viewport is different from the shape (height to width ratio) of the window.

FUNCTIONAL GRAPHICS

For plotting the graph of a function, DATA statements are not needed. The program *Function Plotter* on page 92 allows you to define a function in line 530 and to plot its graph. The viewport is specified as before in lines 640 through 670. The left and right world coordinates of the window now correspond to the domain (X values) of the function to be plotted. The range of Y values is calculated and displayed by lines 120 and 130. If the graph does not fit within the viewport, change the values of the window's WT and WB to match Y MAX and Y MIN and run the program again. Add line 155 GETKEY A$ if you're using a single monitor for text and graphics. Press any key to return to text mode.

The viewport coordinates affect only the amount of the screen and the location in which the graph is displayed. To magnify, reduce, or shift the portion of the graph being viewed, you must change the world coordinates of the window. To plot more than one function on the same graph, add these lines:

```
111 CT = CT + 1
112 ON CT GOSUB 6000, 6100, 120
113 GOTO 50
6000 DEF FNA(X) = COS(X) : RETURN
6100 DEF FNA(X) = SIN(X)/X : RETURN
```

Put your additional functions in lines 6000 and 6100. You can modify line 112 to handle even more functions.

Because of the dummy PRINT statement in line 1020, the NoScroll key will allow you to temporarily stop the plotting, if desired. Change the step size of the X values in line 550 to make the graph denser or sparser.

These programs are the groundwork for some high-powered graphics work. The primary tool needed to complete this graphics package is a clipping routine. The limiting routine at line 3000 will distort any figure in the *Moebius Plotter* which goes outside of the window boundaries. Make sure that the window is large enough to include the entire figure.

Putting graphs and graphics exactly where you want them has never been easier. Enough words. On with the pictures. □ *SEE PROGRAM LISTINGS ON PAGE 92*

GETTING UP TO SPEED

Commodore 128 Graphics, Part III

By Mark Andrews

Given the right software, the Commodore 128 can understand many languages—BASIC, C, LOGO, Forth, and dozens more. But over the years, only one language has been used to create any significant number of commercial-quality high-resolution graphics programs. That language is—wouldn't you know it?—assembly language.

The reason, of course, is speed. In last month's column, we saw how painfully slow BASIC can be when it's called upon to handle a graphics program—particularly a high-resolution graphics program. This month, you'll get a chance to type and run two graphics routines that are written completely in assembly language and—not surprisingly—run considerably faster than last month's BASIC programs.

This month's program, titled HRDEMO.S, is actually two hi-res programs in one. It contains one routine that will fill a high resolution screen with the color of your choice, and another that will draw a square on a high resolution screen.

The HRDEMO.S program was written with a *Merlin 64* assembler on a Commodore 128 running in C-64 mode. With minor modifications, most of which have been discussed in previous columns, it could be typed and assembled using another C-64 or C-128 assembler. It was designed to be run in 40-column mode on a Commodore 128, but with other minor changes can be modified to run on a Commodore 64.

The HRDEMO.S program, like most good graphics programs, was written using a rather sophisticated but widely used programming technique called bit-mapping. Here's how bit-mapping works in C-128 programs:

Deep inside the C-128's memory banks, in a block of RAM that ordinarily extends from memory address $2000 to memory address $3FFF (or from 8192 to 16383 in decimal notation), is a block of RAM called a high resolution screen map. When the C-128 is in its 40-column hi-res mode, each individual bit of data stored in this block of RAM controls one dot, or pixel, on the computer's screen. If a data bit stored in the C-128's screen map is turned off, then the dot on the screen that corresponds to that bit is also turned off. And if a screen map bit is turned on, its corresponding screen dot is also turned on.

Since the C-128's hi-res screen is 320 dots wide by 200 dots high, a program—or a programmer—can exercise individual control over 64,000 separate dots by using bit-setting, bit-clearing, and bit-shifting techniques. That's a lot of control for a programmer to have over a screen display—and that's how high resolution graphics got its name!

THERE'S A CATCH, THOUGH

Since the C-128's 40-column screen is 320 dots wide by 200 dots deep, it is possible to pinpoint the location of any dot on the screen by using two coordinates: an X coordinate that represents the dot's horizontal position, and a Y coordinate that represents its vertical position. Unfortunately, though, there is only an indirect relationship between a dot's screen coordinates and its corresponding bit in screen memory. The 64,000 bits that make up the C-128's screen are laid out slightly differently than are their corresponding bits in screen RAM. And that quirk makes it somewhat difficult to bit-map the C-128 screen.

Here's a brief explanation of this problem: The data stored in the C-128's screen memory is arranged in a very straightforward way—one bit right after the other, in 8,000 consecutive bytes of screen RAM. But the C-128's hi-res screen is arranged in quite a different manner: instead of being laid out in consecutive bytes, like screen RAM, it is split up into a grid of 1,000 rectangles, each one eight bytes high. This grid measures 40 rectangles wide by 20 rectangles deep—1,000 cells in all, arranged exactly like the characters on the C-128's 40-column text screen.

Figure 1 illustrates the relationship between the screen memory of the Commodore 64 and the display which the data produces on the screen. It shows where the first 32 bytes of screen RAM starting at memory address $2000 would be situated if it were displayed on a high resolution screen.

Figure 1
How Data Is Displayed on the Screen

	COL. 1	COL. 2	COL. 3	COL. 4
LINE 0	$2000	$2008	$2010	$2018
LINE 1	$2001	$2009	$2011	$2019
LINE 2	$2002	$200A	$2012	$201A
LINE 3	$2003	$200B	$2013	$201B
LINE 4	$2004	$200C	$2014	$201C
LINE 5	$2005	$200D	$2015	$201D
LINE 6	$2006	$200E	$2016	$201E
LINE 7	$2007	$200F	$2017	$201F

The text-oriented layout shown in Figure 1 makes it quite easy to display text on the C-128's screen, since each

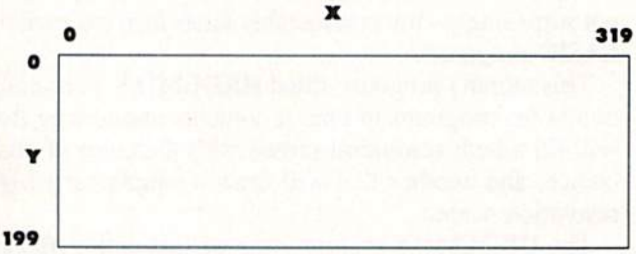


eight dot by eight dot character that appears on the screen can be fashioned from 64 consecutive bits of screen RAM. But it certainly complicates the job of the programmer working in hi-res graphics, since it eliminates the possibility of using straight X/Y coordinates to plot dots on a high resolution screen. Instead, the relationship between each dot on the screen and its corresponding bit in screen RAM must be painstakingly calculated, using what must be one of the most complicated algorithms in the world of hi-res graphics programming.

HOW IT WORKS

To illustrate how this complex algorithm works, let's go ahead and devise a system of coordinates for a 320 dot by 200 dot hi-res screen, using the letter X to represent each of the 320 dots going across the screen and the letter Y to represent each of the 200 dots (or bytes) extending from the top of the screen to the bottom. This arrangement is illustrated in Figure 2.

Figure 2
Using X/Y Coordinates



As Figure 2 shows, there are 320 possible X coordinates on a hi-res screen, ranging from 0 to 319. And there are 200 possible Y coordinates, ranging from 0 to 199. So an X coordinate and a Y coordinate, used together, can be used to plot any dot on the screen. But, since the screen is actually divided into 1000 matrices of 64 dots each, some kind of conversion formula must be devised if these screen X and Y coordinates are to be of any help at all in accessing data in screen RAM.

Actually, the algorithm that is most often used for converting C-128 coordinates into screen memory addresses is made up of several parts:

First, since each rectangle on the screen is eight dots wide by eight dots high, both the X coordinate and the Y coordinate must be divided by eight. So, if we use the variable ROW to represent the starting address of a horizontal eight byte row of dots, and the variable COL to represent the starting address of an eight byte column of dots, we could start our algorithm with these two equations:

```
ROW = INT(Y/8)  and  COL = INT(X/8)
```

Next, since each horizontal row of dots is made up of eight horizontal lines, we could number those lines 0 through 7 and find the line number of the dot in ques-

tion by using this equation:

```
LINE = Y AND 7
```

Another odd quirk about the C-128 screen is that it displays the eight bits in each byte of screen RAM in the opposite direction from the direction in which they are stored in memory—with bit 0 on the left of each byte shown on the screen, and bit 7 on the right. So an equation like this is needed to get the eight bits in each byte of screen RAM into the proper order for a screen display:

```
BIT = 7 - (X AND 7)
```

Once the location of a bit in screen memory has been determined, the base address of screen RAM can be added into the equation, and the sum should be the address of the byte in which the bit in question is situated. So now let's put all of the above formulas together and add them to the base address of the C-128's screen memory. We could do that with a formula like this:

```
BYTE = ROW * 320 + COL * 8 + LINE + BASE
```

Finally, once the RAM address of a byte has been calculated, the state of any given bit in that byte can be changed with a statement such as this:

```
POKE BYTE,PEEK(BYTE) OR 2  BIT
```

In order to plot a dot on a high resolution screen, it is also necessary to understand the use of the C-128's color map, which begins at memory address $1C00 (7168 in decimal notation). The C-128 color map contains 1000 bytes, each of which determines the color of one eight byte matrix on the screen. The upper four bits of each location in color memory define the color of each bit that is set to 1 in a corresponding eight dot by eight dot matrix on the screen. The lower four bits in each color map location define the color of any bit that is cleared to 0 in that same eight by eight matrix of pixels.

Because of the limitations of this system, the C-128 does not offer the programmer as much control over setting screen colors as it does over whether individual dots on the screen are off or on; only two colors are available in each eight dot by eight dot (character size) matrix, and each dot in that matrix must be displayed in one of those two colors. However, there is no overall restriction on how many of the C-128's 16 colors can be displayed on the screen.

Now that we know how the C-128's screen map and color map work, we're ready to take a look at

HRDEMO.S, the program that goes with this column (see page 90). As mentioned previously, the program contains two separate routines. And, as pointed out in the comments in lines 7 and 8 of the program, each of these routines has a separate entry point. Once the HRDEMO.S program is typed, assembled, and stored on a disk as HRDEMO.O, the routine called FILLSCR, which fills the screen with color, can be loaded and executed by typing the BASIC 7.0 commands

```
BLOAD "HRDEMO.O":SYS 4864
```

To load and run the square-drawing routine, you can type

```
BLOAD "HRDEMO.O":SYS 4867
```

As you can see by looking at line 10, the HRDEMO.S program will assemble beginning at memory address $1300, or 4864 in decimal notation. So, if the program is executed using the command SYS 4864, it will start at line 54 and then jump to line 262, where the FILLSCR routine begins. But if it is executed using the command SYS 4867, it will start at line 55 and then jump to line 290, the first line of the DRAWSQ program. Both FILLSCR and DRAWSQ end with infinite loops (loops that continue forever), so there is no elegant way to get out of either routine. But HRDEMO.S is not yet a finished program, and this bug will be removed as we continue to work with the program in future columns.

Let's look now at the FILLSCR section of the program, which begins at line 262. Both FILLSCR and DRAWSQ begin with jumps to a subroutine called HIRES, which begins at line 217. HIRES, using techniques that have been discussed in previous columns, activates the C-128's high resolution mode and clears the computer's screen map. Then, using a variable called COLOR, it fills the C-128's color map with the value $40, which will produce a blue foreground and a black background on the screen. (You can use a different color set, of course, by changing the value of the COLOR variable.)

The heart of the program is an assembly language dot-plotting routine labeled PLOT, which extends from line 105 to line 258. This module, as you can see by looking at the remarks in the source code, works just like the dot-plotting routines that were included in last month's programs.

The FILLSCR routine, with the help of a Y-register loop, uses the subroutine PLOT to fill the screen with color. The DRAWSQ routine, using vertical and horizontal lines with predetermined starting and ending points, calls the PLOT subroutine to draw a square on the screen.

When you type, assemble, and run the HRDEMO.S program, you'll see that while DRAWSQ is pretty speedy, FILLSCR runs rather slowly—especially for an assembly language program. One reason for the program's sluggishness is that it painstakingly calculates the fill value for every dot on the screen, even though every dot is displayed in the same color. If you understand how the program works, you should be able to correct this deficiency without too much trouble; I'll leave it to you to figure out how.

Another reason that FILLSCR runs so slowly—and that DRAWSQ, despite its appearance of speed, also runs more slowly than it should—is that the PLOT subroutine calculates the complete address of each byte on the screen every time the byte has to be accessed. This procedure, as professional programmers discovered long ago, can be speeded up greatly with the help of a programming tool called a Y-lookup table. This, as its name indicates, is a table that contains the starting address of each line, or Y coordinate, on a screen map. A Y-lookup table contains only 200 addresses, since there are only 200 lines on the screen, so it can be created very quickly and then stored in memory. And once a Y-lookup table has been created, it can eliminate the necessity of looking up Y addresses. Instead, when a program needs a Y coordinate address, all it has to do is look up the address using its Y-lookup table.

The creation and use of Y-lookup tables, and a few other secrets of superfast graphics programming, will be explored—and demonstrated—in next month's column. ☐

SEE PROGRAM LISTINGS ON PAGE 90

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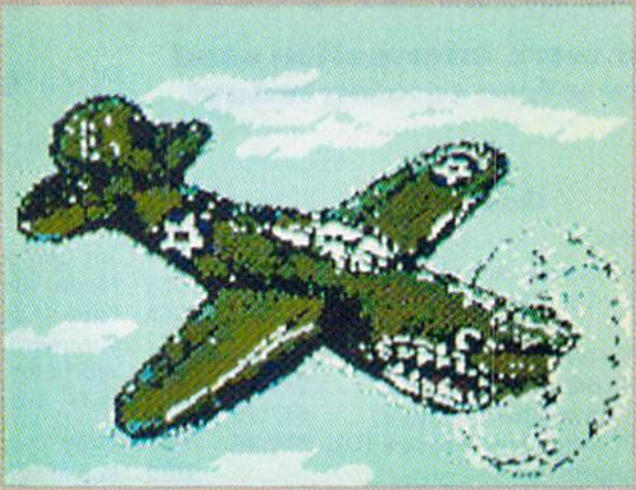
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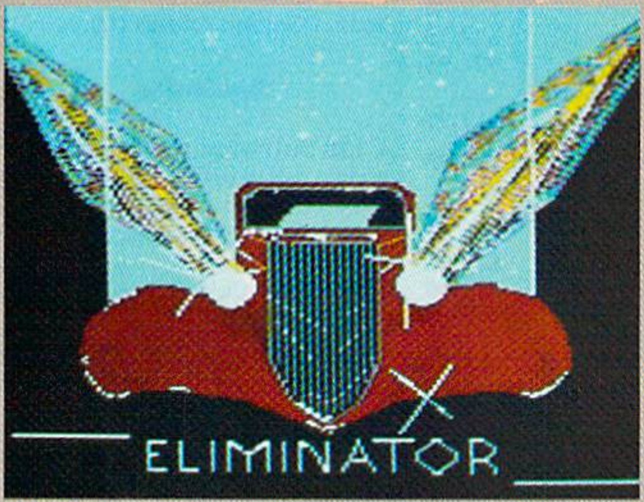


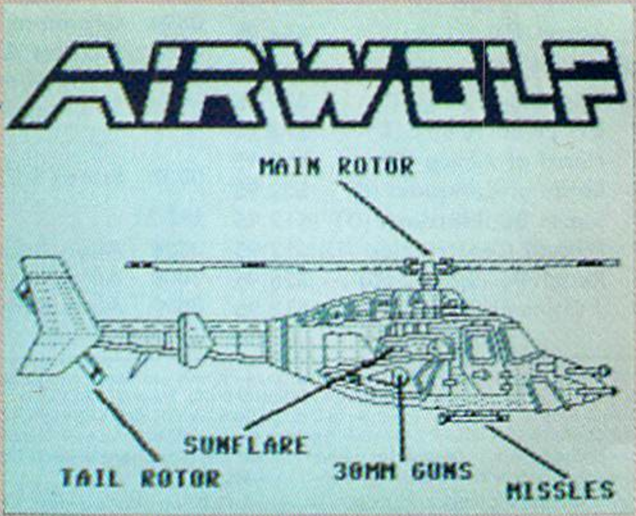
Contributors to *Ahoy!'s Art Gallery* will receive royalties based on the sale of disks. Send your best work on disk, accompanied by a stamped and self-addressed mailer, to Morton Kevelson, P.O. Box 260, Homecrest Station, Brooklyn, NY 11229. Indicate the drawing package that was used to create the image. If you employed a bit map of your own design, indicate the appropriate file parameters, i.e., hi-res or multicolor, location of bit map, screen or color data.

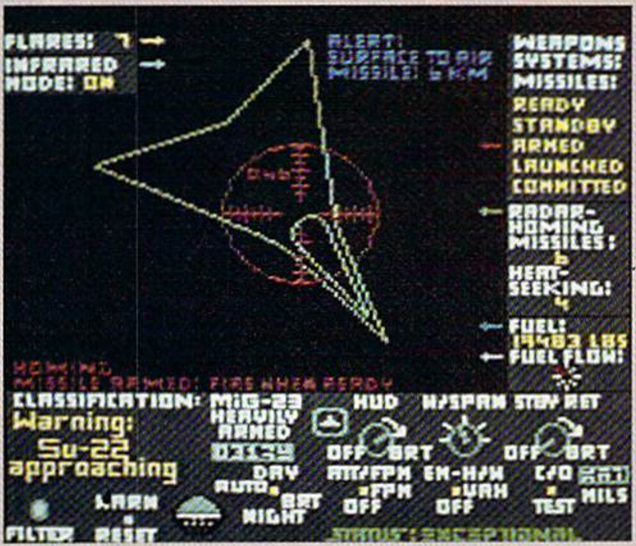
Given *Ahoy!'s* nautical motif, we'd like nothing better than to fill an *Art Gallery* with images of oceangoing vessels—but it's ships with wings that have traditionally captured the imagination of computer programmers. Last month's installment featured several screens for the spaceship set; this month we nosedive into the stratosphere for a dynamic aero assortment. In the top row are *P-40*, crafted on Koala by R. J. Belcher (Advance, NC); *Dogfight*, also on Koala, by Tod Baldridge (Markleville, IN); and *F-4 Jet* by Richard and Pamela Winters (Shreveport, LA). In the middle row are *Spitfire*, drawn with Koala Pad and *Koala Painter* by Barri Olson (Madison, WI) and *Davinci*, also created with Koala by Joseph P. McCarthy (Trumbull, CT), a former animator with Terrytoons. In the bottom flank are *Eliminator*, based on the ZZ Top album cover, by Kerry L. Gish (Kewanee, IL)—this month's only non-aviation image; *Airwolf*, rendered on *DOODLE!* by Steven Distasio (Valhalla, NY) and demonstrating the maximum resolution of the 64's 320 X 200 pixel hi-res mode; *F-15 881* on Koala by Gary Tully (Highland, CA); and *X Wing Fighter* on Koala by John Matthews Jr. (San Antonio, TX). Keep 'em flying!

ART GALLERY DISK SALE

Art Gallery images are available on disk. High resolution bit-mapped images are available in *DOODLE!* format. Multicolor bit-mapped images are available in *Koala* format. Each disk includes a slide show program for easy viewing. *DOODLE!* disks include a bit map screen dump utility for the 1525 or properly interfaced dot matrix printer. *Koala* disks include a set of custom routines for bidirectional conversion to other multicolor formats. The conversion routines were expressly developed for the *Art Gallery* by Michael Beutjer of K.T. Software, author of the *Koala Printer* program and *Quad Print* (June '85 *Ahoy!*). Formats presently supported are *Cadpic, Peripheral Vision, Paint Magic*, and *Flying Colors*. Disks are available for $15 from Morton Kevelson, P.O. Box 260, Homecrest Station, Brooklyn, NY 11229. Send a stamped and self-addressed envelope for a complete listing (or send $10 and receive a sample disk of *DOODLE!* and *Koala* images with slide shows).



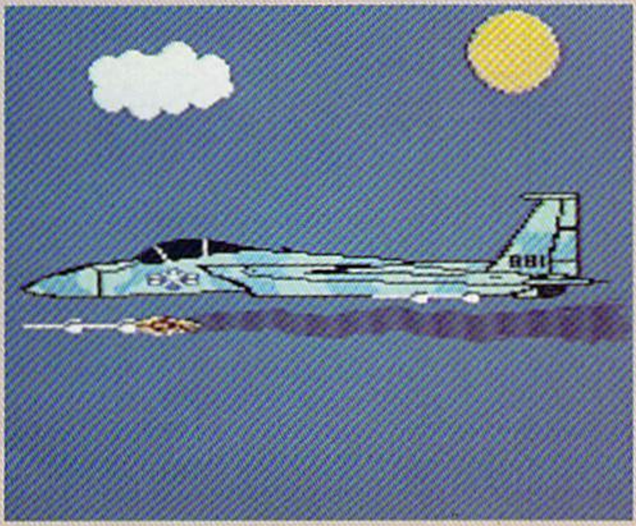


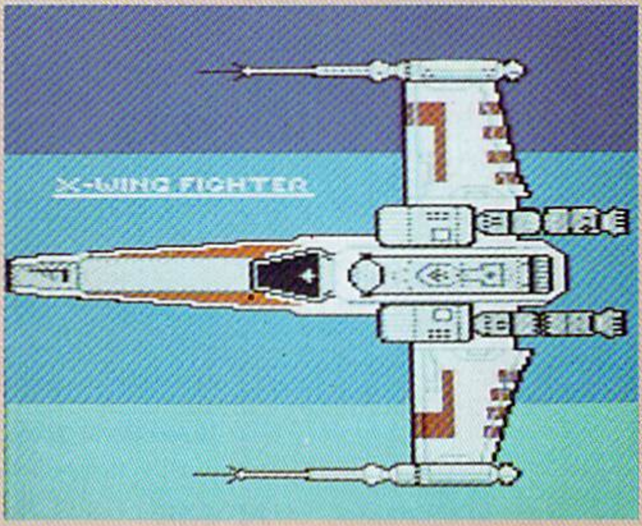

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SPEECH64

Digitized Speech Without Special Hardware



By Scott Baggs

One of the most fascinating applications of microcomputers is speech synthesis. Unfortunately, giving your computer the gift of speech usually involves purchasing expensive hardware. Using *Speech64,* you can give your Commodore 64 a voice without any special equipment. You will need a cassette recorder and Datasette for digitizing your speech, but you need no extra hardware for playback. Your recorded voice is reproduced in the standard audio output of any Commodore 64.

Before we get started, here is a quick overview of what we are going to do. First you will record your voice onto a cassette tape using any cassette tape recorder. Next you will place this tape into the Datasette connected to your Commodore 64. Please note that it is a tape recording of a voice and not a computer program that is loaded into the Datasette. Finally, you will run the *Speech64* program, which will record the speech from the Datasette. You will then be able to play back and save the speech data. The point here is that we are not using the Datasette to load or save programs (unless you do not have a disk drive), but only as a means to input the speech signal.

Let's get started. Type in the *Speech64* program on page 103 and save it. Now, using a standard cassette recorder, record a short phrase (under 8 seconds). If you are using a recorder with a built-in microphone, use a plug-in mike instead of the built-in one. The reason is that the built-in microphones tend to pick up too much noise, and your voice will sound very thin on the computer. This is an interesting phenomenon, and you may wish to experiment with different microphones. Anyway, once you have recorded a few seconds' worth of speech on a cassette tape, rewind the tape back to the beginning of your speech and place the tape in the Datasette (connected to the C-64). Run the *Speech64* program and choose the RECORD option from the menu. You will be instructed to press play on the Datasette. When you press play, the screen will blank while your voice is read from the tape into the computer. After about 8 seconds, the menu will reappear, indicating that the recording is done. Press stop on the Datasette. Now choose option 2, PLAYBACK, from the menu. You should now hear your digitized voice emanating from the monitor's speaker. The reproduced speech will have a raspy, buzzing quality similar to that of a CB radio, but it should be quite intelligible. You should speak slowly and articulate your words to get the best results when recording your voice on tape.

At this point you may save the digital speech data using option 4 from the menu. Note that this is the digitized speech data, and not the original voice signal you recorded onto cassette earlier. By saving this digital data, you can use it later in your BASIC programs. The default device is the disk drive, but you may save to cassette by entering a 1 instead of 8 for the device number. If you are saving to cassette, do not forget to replace the cassette with your voice on it with a program cassette.

Once you have digitized and saved your speech, you are ready to add a voice to your own BASIC program. All you need to do is put the following lines in your pro-

gram:

```
10 IF A=0 THEN A=1: LOAD"YOURDATA",8,1
20 GOSUB 4000 :REM POKE ML ROUTINES
30 REM
40 REM PUT YOUR PROGRAM HERE
50 REM
2999 STOP :REM END OF YOUR PROGRAM
3000 REM SAY THE PHRASE
3010 SRT=64 : A=49154 : POKE 49358,5
3020 POKEA,0:POKEA+1,SRT:POKEA+3,SRT+24:
POKEA+2,0
3030 POKE53265,PEEK(53265)AND239 :REM BL
ANK SCREEN
3040 SYS 49287 :REM SPEECH PLAYBACK
3050 POKE53265,PEEK(53265)OR16 :REM ENAB
LE SCREEN
3060 RETURN
4000 REM PUT LINES 4000-5430 FROM SPEECH
64 PROGRAM HERE
```

Whenever you want your computer to speak, just use GOSUB 3000. Line 10 assumes you are using disk, but if you want to load from cassette, just change the 8 to a 1.

You may want to have some fun altering your digitized voice by varying the pitch. You may do this in line 35 of *Speech64* which POKEs location 49358 with a 5. First, record the phrase using the initial value of 5. Then, during playback, replacing the number 5 with a smaller number will increase the pitch; a larger number will decrease the pitch.

One other option you have is whether or not you wish to blank the screen during playback. Speech quality is slightly degraded if you do not blank the screen, because the computer must spend some time updating the display. If you choose to leave the screen visible during playback, you may omit line 3030 from the above program.

For those of you who are interested in the technical aspects of how *Speech64* works, it is based on a method of signal processing called zero-crossing analysis. Essentially, this means that the analog speech signal is transformed into a square wave of 0's and 1's that the computer can understand. These 0's and 1's are used to click the speaker on and off at audio frequency, hence reproducing the original signal. The advantage of this technique is that it is a relatively simple process and requires very little memory. On the other hand, we have to pay a price in terms of speech quality—the sound is somewhat raspy but it is intelligible.

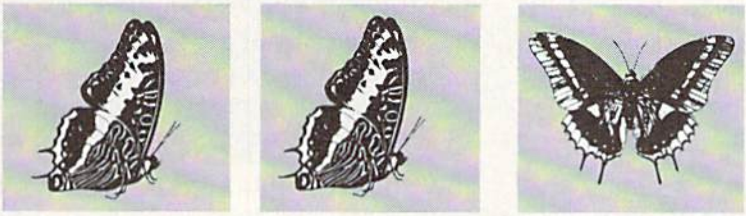
I have found experimenting with speech reproduction on the Commodore 64 to be rewarding, educational, and just plain fun. I hope that *Speech64* proves to be just as exciting for you. □

SEE PROGRAM LISTING ON PAGE 103

MATCHBLOCKS

For the C-64

By James A. Shephard



Matchblocks is a game that is as much fun playing solitaire as with a group of up to 10 players. As the name implies, the object is to match blocks. There are two versions. In one, a match consists of two identical blocks; in the more difficult version, three identical blocks. A block contains a colored picture created from symbols in the C-64's graphics and letter set. Each picture is two symbols wide by two symbols high. Later in this article you will learn how to alter the block set, or even create your own.

PLAYING THE GAME

To start, plug in a joystick in Port 1. (The C-64 should always be turned off when inserting or removing a joystick.) Then load and run the program. After displaying the playing board, the program asks how many players there are, and for the name of each player to be typed in. As each player types his name, it moves across the bottom and up the right side of the screen to its position on the scoreboard.

After all names have been entered, you are asked to choose the two or three block version. Then the 54 blocks are covered and a white flashing cursor appears in the center. You are now ready to begin play.

Players take turns trying to match blocks. To select a block, move the joystick until the cursor is positioned on the block you desire. Pressing the fire button selects the block and exposes the picture that the block contains.

TWO BLOCK VERSION

In this version, a match equals two identical blocks. When this occurs the MATCH in the title flashes and the computer plays the 'CHARGE' theme. The player's score is increased by one and the player gets another turn. When no match occurs, the computer buzzes and displays NO MATCH at the bottom of the screen and play passes to the next player.

THREE BLOCK VERSION

This is the same as the two block version, only more difficult because a match is three identical blocks. A player's turn is not over until three blocks have been selected, even if the first two do not match.

WINNING THE GAME

The object is to match all blocks and clear the board. When there are two or more players, the winner is the person with the most matches after the entire board has been cleared, regardless of the number of rounds. When played solitaire, the number of rounds is a way to determine how well a player has done against other solitaire players, or if he has beaten his own record.

CREATING OR MODIFYING A BLOCK SET

Matchblocks contains a short utility program which displays the entire block set on the screen. At a READY prompt, type RUN800 and press the return key to see how this works. The first two rows displayed on the screen are the blocks used in both the two block version and the three block version. The third row is only used in the two block version.

Each program line from 700 to 780 contains the data for three blocks. Each block data line contains fifteen numbers, so there are five for each block. The first number determines the color of the block. The second, third, fourth, and fifth numbers determine the upper left, upper right, lower left, and lower right symbols that make up the block picture. To clarify, program line 700 reads as follows:

```
700 DATA 01,233,233,95,105,13,122,76,80,
79,07,10 8,123,124,126
```

The first five numbers are data for the white diamond, the next five are data for the light green cross, and the last five are data for the yellow square. If the first number 01 were changed to 02, the diamond would become red, based on the following C-64 character color codes:

0 Black	4 Purple	8 Orange	12 Gray 2
1 White	5 Green	9 Brown	13 Light Green
2 Red	6 Blue	10 Light Red	14 Light Blue
3 Cyan	7 Yellow	11 Gray 1	15 Gray 3

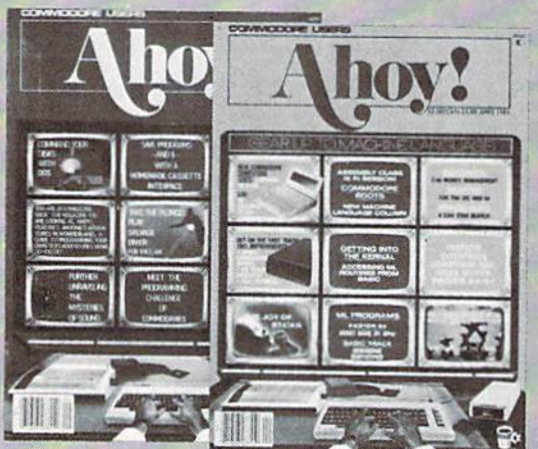
The second, third, fourth, and fifth numbers are screen display codes which can be found in the POKE column on pages 132-134 of your *Commodore 64 User's Guide*. The character that the POKE value represents is found

Continued on page 76

Back Issues

Try this experiment! Flip through any issue of *Ahoy!* that you've finished reading. Add up the hours of programming toil our feature articles and tutorials saved you—the hours of shopping our expansive news section saved you—and the money our unbiased reviews saved you—and see if the magazine didn't pay for itself! Then ask yourself: can you afford to be without a single time- and money-saving back issue?

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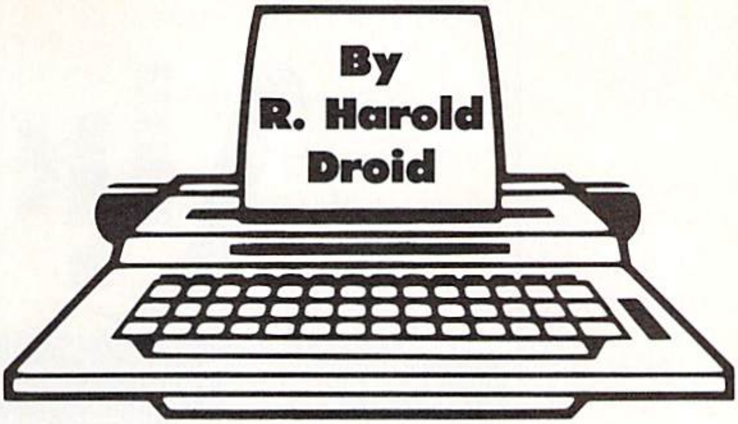
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DUAL DUMP-128



I know it's happened to you before. You're walking through the woods, minding your own business, when you come upon a pod of bears having a costume party. The one wearing the Hawaiian shirt is obviously proud of his costume because, having spied the camera around your neck, he asks you to take his picture. You're more than happy to oblige, since you're considering maybe keeping a copy or two for yourself. You reach down, and—no film.

It pays to keep your camera loaded. The same thing applies to a session at the computer. That's why a screen dump utility is one of the most useful things you can pack into your machine. It sends the contents of the display screen to your printer. It's great for debugging, obtaining hard copy of important data, or just for convincing yourself that the strange behavior of your computer isn't a figment of your imagination.

This screen dump program for the C-128 has two particular advantages. One, it works off the interrupt generated by the RESTORE key, which means most programming tricks won't disturb it. Two, it senses whether you're in 40- or 80-column mode, and formats the printout accordingly. Incorporate this as part of an autobooting routine when you power up, and it's out of sight and out of mind. But when a situation pops up that makes you scream for a screen dump, it's at your fingertips.

This convenient feature is available even while a program is running. The program halts, the printer prints, and the program picks up where it left off. The RESTORE key makes it all possible.

Unlike any other key on the keyboard, RESTORE is wired directly to one of the microprocessor's interrupt lines. We all know we can halt a BASIC program by pressing RUN STOP and RESTORE simultaneously. In a nutshell, here's what's happening inside the computer: 1) The RESTORE key sends the interrupt signal to the microprocessor, passing control to the interrupt handler routine; 2) As part of this routine, the RUN STOP key is checked; 3) If RUN STOP is down, the computer resets ("warm starts"); otherwise, the computer returns from the interrupt as though nothing happened. When *Dual Dump-128* is activated, a little diversion takes place. In addition to checking the RUN STOP key, we also check the SHIFT keys. Hold one of them while pressing RESTORE, and you get a screen dump.

Dual Dump-128 is a chunk of machine code that occupies locations $1A00-$1B89 (decimal 6656-7049) in your 128. This is part of the space Commodore has declared as reserved for function key software. (Note: we're not talking about the function key definitions built into the computer that you can change with the KEY command; they're stored somewhere else.) The program supplied POKEs the code into memory and enables the SHIFT/RESTORE feature with a SYS command.

If you desire, you can dispense with the SHIFT/RESTORE combination and call the screen dump routine directly with the command

```
SYS 6659
```

You may find this useful at times, particularly if you'd like to incorporate a screen dump into one of your own programs.

This program is designed for Commodore-compatible printers. It assumes a printer with device number 4. (To dump to a printer with a device number of 5, POKE 6986,5.) When dumping a 40-column screen, the program checks whether the display is lower/upper case or upper case/graphics, and opens the channel to the printer accordingly. 80-column screens are handed a little differently, since the 80-column mode can display both character sets at the same time. For an 80-column screen dump, the printer channel is opened according to the last character that was sent to the screen. The BASIC equivalents of the commands that are used to open the printer channel are

```
OPEN4,4,0 (UPPER CASE/GRAPHICS)
OPEN4,4,7 (LOWER/UPPER CASE)
```

This program is designed for dumping text screens only, not bit-maps. Furthermore, because sprites are a function of the video chip apart from the screen display, they won't appear on your printouts. Reverse characters are changed to non-reversed to save wear and tear on your printhead.

From now on, when something appears on your computer screen that's simply too amazing to believe, a simple SHIFT/RESTORE will preserve it for posterity. ☐

SEE PROGRAM LISTING ON PAGE 96


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MULTI RAM

For the C-64

By Buck Childress

What a great machine! The ol' 64 can do so many different things, you could spend years just exploring its capabilities. With a little help, it can even emulate two or three different computers at one time.

Multi RAM enables the 64 to develop some very useful split personalities. Time and again you've heard of the free area of RAM starting at 49152. Unfortunately, if you don't program in machine language, this area gathers dust. That hardly seems fair. You have as much right to it as any ML programmer does, especially since it's your computer. Now, with the touch of a key, you can access this area of RAM and use it for your BASIC programs. With it, you'll have an additional RAM area of 3837 bytes (about 250 more than the VIC 20). This is a great place to store your smaller programs or subroutines. If you're using a disk drive, you could keep your disk directory here for reference. You'll still have that monstrous 38,911 byte area down below for those monolithic programs. But, if you're like me, most of your BASIC programs aren't even half that size. So why not split this area in two? Press the right keys and presto...you now have two areas of RAM containing 19,453 bytes each (almost 8000 more than the Commodore 16).

All of these areas are completely separate from one another. You can load to, and save from, any one at any time. Programs in one area can be worked on, run (provided they don't POKE data from 53000 up), or newed without affecting the others. In essence, you have three computers in one. This is really handy when you're working on a program. You can store different versions of it in your 'separate' computers.

After saving a copy of *Multi RAM*, run it. The loader will POKE the machine language data into memory and check for errors. *Multi RAM* then activates itself and erases the BASIC loader. If for some reason you want to disable *Multi RAM*, RUN STOP/RESTORE will do the trick. SYS 53000 will reenable it.

Press the CTRL and f1 function keys at the same time. At the upper left of your screen the message "RAM = 1" will appear. This means that you're in the first RAM area (the bottom half of normal BASIC RAM). Now press the CTRL and f3 keys. You'll see "RAM = 2" indicating that you're now in the second RAM area (the top half of normal BASIC RAM). CTRL and f5 places you in the third area of RAM, as "RAM = 3" will verify. This is the area at 49152 that you can dust off. Should you want to use the entire 38,911 byte BASIC RAM area at once, press CTRL and f7. "RAM = 0" will appear, verifying that you're not in any given section and that all of the normal BASIC area is available to you.

You can access any area as often as you like by pressing CTRL and the corresponding function key. And, depending on the RAM area you're using, everything you do (loading, saving, running, etc.) will take place in that area. You can even save a program from one area and load it into another. PRINT FRE(0) will return the bytes free in whichever area you're using.

If you happen to forget which area of RAM you're currently in, press CTRL and RETURN. *Multi RAM* will tell you the area.

Because *Multi RAM* monitors certain pointers and continually updates various data to reflect the status of these pointers, don't load and run it again (unless, of course, you turn the computer off). This is why *Multi RAM* activates itself and erases the loader once it's been run. Remember, make sure you have a good copy saved before you run *Multi RAM* for the first time.

Give *Multi RAM* a try. It's like having three entirely separate computers at your disposal. And, best of all, you only had to pay for one! □

SEE PROGRAM LISTING ON PAGE 109

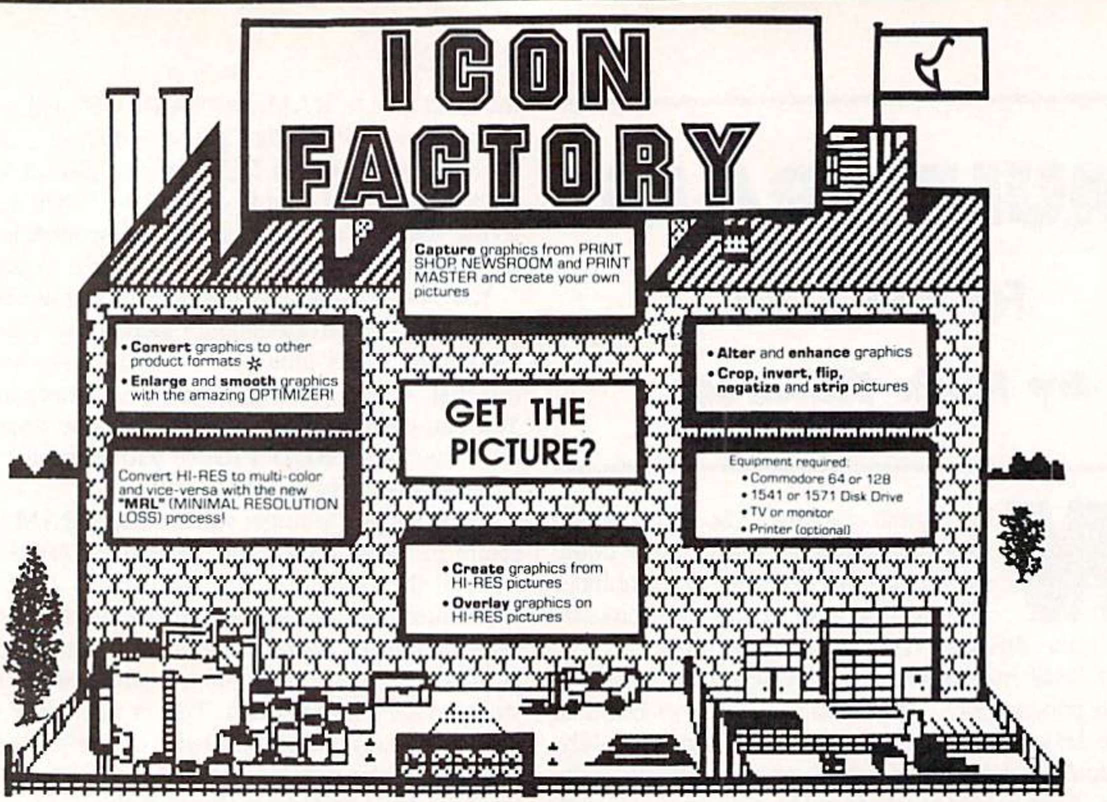


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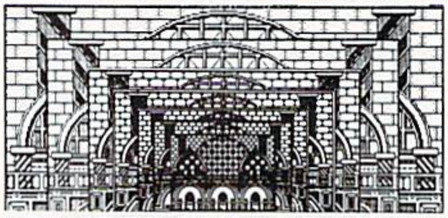
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Reader Service No. 226

Featured This Month:



The Music Studio *utilizes icons.* *READER SERVICE NO. 205*

MAKING MUSIC ON THE C-64

Composing on the Computer

By Joyce Worley

Even someone with a tin ear and 10 thumbs can write and perform songs with easy-to-operate music software. Such programs also allow more accomplished musicians to add all kinds of special effects to dress up their melodic creations.

There are many music programs available for the Commodore 64 which can mimic standard orchestral instruments and also produce a panoply of electronic boops, bops, and beeps. Picking the right one is a question of correlating the age, talent, and needs of the user with the features offered by the various titles.

Beginners may need a program specifically designed to teach standard notation, which would be superfluous for a trained musician. A program which simulates a keyboard is especially helpful to those who play by ear. Programs which generate finished sheet music remove the burden of transcribing compositions.

The composition procedure is another major point of difference among the various programs. Some let the user play the console piano-style, though others enter notes by name. The latter system is tough if you don't know how each note sounds, but it can serve as an effective teaching tool to reinforce regular music lessons. Joystick input is a third alternative. The computerist chooses notes from a menu and drops them on a staff much like a fairy godmother scatters moondust with her wand.

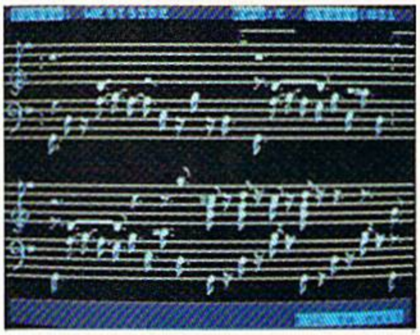
Don't automatically assume the newest software is best. Some of the older programs are exceptionally user-friendly, and they are frequently available at bargain prices. It's the features, not the copyright date on the disk, that counts.

Here are some of the best music software titles available for the Commodore 64/128.

Songwriter (Scarborough) puts a piano keyboard on screen. Musicians manipulate a joystick- or keyboard-controlled cursor over this field and tap the button or space bar to record notes. Composers can hear each note as it is added, so even "by-ear" musicians can easily perfect tunes by zapping notes that don't sound right.

The notes appear on something which resembles a piano roll, instead of on a staff, and a metronome provides a visual indication of the tempo. *Songwriter* has 28 prerecorded melodies on disk, which the user can play or customize as desired.

MusiCalc 1 Synthesizer & Sequencer (Waveform) is a powerful synthesizer which permits composers to



Bank Street MW: *compose by cursor.* *READER SERVICE NO. 206*

create three-part chords or harmonies. Using the console like a piano keyboard, the computerist enters one music track at a time.

The display shows the music in the form of a diagram, instead of like sheet music. This makes it easier for those who can't read music to visualize the score.

The computerist can pillage the disk's music library for ingredients in new compositions. The available bits and pieces range from Bach to rock.

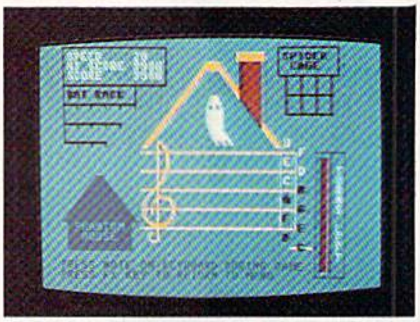
It's not an easy program to master. Although the "quick start" manual helps, most would-be musicians will have to study the tutorial to learn about all of the features and special options. Once the composer understands the intricacies of the synthesizer, there's almost no limit to the variety of sounds and rhythms.

Studio 64 (Entech) makes composing easy even for those who don't read notes. As the computerist picks out tunes on the console keyboard, they're automatically transcribed to the bass or treble clefs on screen. A built-in processor deletes bad notes, moves entire blocks of music, or repeats sections.

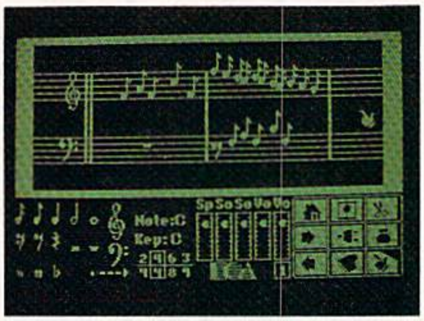
Unlimited tonal variations are pos-



The Music Shop: *packed with options.*
READER SERVICE NO. 207



Notable Phantom: *1½ octave overlay.*
READER SERVICE NO. 208



Music Construction Set: *many effects.*
READER SERVICE NO. 209

sible. It is even possible to change the background colors of the onscreen notation.

The composer enters three voice lines for melody, harmony, and bass separately on the console. The playback combines these, and performs the opus with the selected tonal colorations.

Studio 64 is a perfect example of why it doesn't pay to snub older music disks. It lacks the fancy graphics found in newer designs, but it's a full-scale composing tool which unlocks the power of the SID chip.

Bank Street Music Writer (Mindscape) lets users place notes, rests, and staff bars on staffs by moving a cursor to the desired location. It sounds each note as it is entered, so composers get instant feedback.

The three voices are programmed at the same time, but they can be played back separately or in any combination. Each voice, depicted in a different color on the display, has its own volume and tone.

Bank Street Music Writer, like most synthesizers, incorporates editing options which work like a word processor. Musicians can cut and paste sections to create professional-caliber songs. This sophisticated composing package prints out compositions as sheet music. Each voice can be transcribed separately if desired, which could come in handy for writing operettas or scoring band or choral selections.

Music Construction Set (Electronic Arts) is a few years old now, but it has most of the features found in the newer packages. The joystick picks up notes from icons and drops them into place on musical staffs.

Other icons control the speed, volume, and quality of the sound. *Music Construction Set* can imitate 13 instruments and produce an assortment of special effects.

The graphics aren't so pretty and the keyboard controls are a bit cumbersome. Yet the proof of the pudding is in the eating, and this program can cook up some mighty tasty musical recipes.

The Music Studio (Activision) was reviewed last issue (see page 65). This top quality tool takes a unique approach to composition. The computerist uses icons and menus to create musical passages, and can add lyrics which the program prints out on the finished sheet music.

The Music Shop (Broderbund) is a state-of-the-art program by writing, editing, saving, and printing music. The composer chooses notes from a menu and drops them onto the staffs.

One advantage of this title over some others is that it can handle songs of up to 20 pages of sheet music notation. The program is packed with useful options. It can produce whole notes to 32nd notes, dotted notes, ties and triplets, eight time signatures, and varied endings for each song. Pull-down menus and onscreen prompts make it a snap to use, even for beginners.

The Advanced Music System (Firebird) is a complex composition tool which utilizes icons and pop-up menus. The editor lets computerists enter songs either by playing the keyboard like a piano or by choosing notes from menus with the joystick. It's nice to have this choice of input, particularly in families where would-be composers may possess varying degrees of musical literacy.

A less ambitious, and more economical, version of the program also

A BRIEF HISTORY OF COMPUTER GAME AUDIO

In the beginning, there was silence.

After a time, beeps and boops were heard emanating from game consoles across the land. These were followed by buzzes, pops, and, of course, kabooms. Then came the words, the music, and digitization.

Let's return to the very beginning.

Sound was an afterthought on home computers. Back in the late 1970s, the TRS-80, Radio Shack's groundbreaking entry into the nascent home computer market, had no sound capability at all. And the Apple II, while it can produce sounds, generates them through a tiny, onboard speaker.

Audio is a captive of the hardware. If the sound chip can produce the sound, fine. When the programmer attempts to overcome hardware shortcomings with the software, however, the rest of the program almost always suffers.

It wasn't until the low-priced entertainment-oriented systems such as the C-64 and the Atari 400/800 came along that sound became a meaningful concern for software developers. The best computer sound became the province of the mass-market micros because these machines stress entertainment functions.

Improved sound had an immediate and dramatic effect on users. Just as movie audiences turned their backs on silent films after talkies arrived, computerists soon lost interest in the TRS-80, and began buying special sound-enhancing circuit boards and speakers for their Apple

exists: *The Concise Music System.* This pares away the linker and printer modules, but it still offers both methods of data entry and has synthesizer capability.

Rock N' Rhythm (Spinnaker) takes a lighthearted approach to synthesizers. Musicians "cut records" in a computerized recording studio and play them back on a built-in jukebox that holds up to 18 new songs, plus nine prerecorded tunes.

Composers can multitrack songs with melody, harmony, and rhythm accompaniment. A paper overlay turns the console into a keyboard, and users record notes by typing their names onto a checkerboard screen which resembles a grid for a word-search game more than a staff. The program teaches the names of notes, but not how to read music.

The joystick-operated rhythm screen provides preset cadences and cymbal backbeats, as well as a chance to pound out your own rhythm on the drums. An onscreen tape recorder plays the works.

Kids ages 5-10 study the basics of piano with *The Notable Phantom* (DesignWare) while they compete in music educational games against specters, spiders, and the Phantom. It comes with a keyboard overlay that provides 1½ standard piano octaves. Ghouls from a haunted house help kids practice note identification, ghosts challenge users to match notes on a staff by striking the same ones on the keyboard, and kids cage spiders by playing the same notes as the names they drag on screen.

The Notable Phantom comes with a book of melodies, and budding tunesmiths can create their own songs and save them for later. This is not a complete synthesizer, since it doesn't have all the sound-altering functions and other special features, but it's great for kids just learning to read music and play the piano.

Prokofiev's Peter and The Wolf Music (Fisher-Price) introduces preschoolers (ages 3-6) to the principles of music with seven games based on the classic story. The student first plays a simple adventure which leads him into the other six musical tutorials. The program helps tots distinguish pitches, differentiate tunes, and identify musical themes associated with specific characters from Peter and the Wolf. Although it doesn't take the place of a real music synthesizer, this offers kids a good head start.

Music is man's oldest artform. With the help of one of these wonder programs, you can finally let that song in your heart ring out!

THE SOUND OF ENTERTAINMENT

How Audio Enhances Commodore Entertainment Programs

By Bill Kunkel

Just as movies were silent until "The Jazz Singer" made a breakthrough, the earliest computer games were likewise mute. Finally, as with the silver screen, computer games found their voice. And since then, they haven't shown any inclination to shut up.

Historically, it is not uncommon for visually oriented media to give short shrift to audio. As long as people have something to look at, the thinking goes, they can live with silence. Even in cinema, where the introduction of sound created such a tremendous stir, most of the technological innovations have centered around heightening the visual impact of movies. Not until studios added Dolby sound to certain films in the mid-1970s was there any significant change in the way filmgoers heard the dialogue.

Computer sound has moved forward at a much faster pace. The first home computers offered users little or nothing in the way of audio. The Apple II has a tinny built-in speaker, and the pioneering TRS-80 maintained total silence during operation (see sidebar: *A Brief History of Computer Game Audio*). Other manufacturers, like Commodore, perceived this lack and, accordingly, aural excellence became a major selling point for systems like the C-64.

The importance of games in the software pantheon made enhanced audio for home computers a necessity. During the early part of this decade, computers were striving to duplicate coin-operated arcade games. What was Pac-Man, after all, without his signature theme song and his beloved "wocka-wocka"?

IIs as well. Virtually overnight, a quality sound chip was a prerequisite on all home computers.

Computers such as the C-64, Atari 800XL, IBM PC, and TI-99/4A produce what we'll call "analog" sound. They use audio generation technology to mimic sounds to the best of their ability. Sometimes the imitation is successful, often it is not.

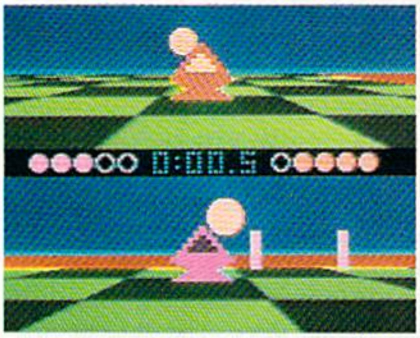
The next step was the use of digital technology to actually reproduce the sound itself. With digitized audio, the computer "hears" a sound, breaks it down, and "remembers" it. On command, the sound is played back or modified, then "reremembered."

The first home computers to use digitized sound techniques are the Macintosh and Amiga (see sidebar, *Amiga: Breaking the Sound Barrier*). It seems quite likely that, once users are exposed to the joys of this technology, even the finest "analog" sound will seem a little passé.

Just as the resolution of the onscreen display continues to improve as available memory increases, so too, will sound resolution. Programmers may well come to view the memory cost of synthesized speech as relatively minor when the system has 500K-2000K of RAM storage.

It is also quite likely that sound will not remain "passive." The technology already exists to input commands and move onscreen cursors with spoken words.

Memory and cost, those ruling stars of the microcomputer world, will dictate how fast this innovation reaches the public. And that means it's only a matter of time before the sound of entertainment takes on new vibrancy and excitement.



Ballblazer: ***a pulse-pounding score.***
READER SERVICE NO. 210



Rescue on Fractalus: ***movielike music.***
READER SERVICE NO. 211



Spelunker: ***plunking theme sets pace.***
READER SERVICE NO. 212

The rise of the Commodore 64 proved to be a major step forward. The C-64's vaunted SID (Sound Interface Device) chip can generate music, sound effects, and even speech of extraordinarily high quality.

The SID chip allows programmers access to three different voices. An "instrument" is selected for each voice, then a setting is determined for the sound's Attack, Decay, Sustain, and Release factors.

The Attack determines an instrument's acceleration. That is, how fast it gets "from zero to sixty," as they say in the car world. Horns, for example, have a slow Attack, while an electric guitar's is quite fast.

Decay governs the point to which the sound levels off after the Attack.

The Sustain determines the level of sound after the Attack.

The Release affects the way a sound ends once it is produced. A quick release means the sound cuts off abruptly once the musician is no longer playing it.

Sounds are grouped according to the patterns they generate. These patterns are called waveforms because of their appearance on paper. Printed sound patterns look something like the readouts generated by lie detectors.

Music not only produces tones, but overtones as well, secondary tones which give an instrument its individual character. These overtones are affected by the waveform the programmer selects.

The four basic waveforms use sound and overtones in conjunction to produce an instrument's timbre or color. The triangle wave has a bright sound, full of overtones, and is used to simulate the mellow sound of a xylophone. The sawtooth wave has a pure sound, with no overtones, and produces the brass and string instruments. The noise wave contains a random mix of all overtones and is used to create the percussion instruments such as a snare drum and high hat. Finally, the pulse wave is used in combination with other waves to vary the harmonics. Adjusting the pulse width brings out certain overtones in other wavse.

The SID chip also gives programmers access to filters. The Hp (High Pass) filters out the low frequencies; the Lp (Low Pass) eliminates high frequencies; and the Bp (Band Pass) boosts the midrange by filtering out the high and low frequencies.

Finally, the programmer must set the Synchronization to combine voices; Resonance, which brings out harmonic overtones; and "Ring Modulation," which blends voices to create a non-harmonic effect.

Three types of sound are commonly used in home computer entertainment products. They are sound effects, music, and speech.

Sound effects have been a major consideration in the creation of modern entertainment software since the primal thump-and-grind of *Space Invaders.* Later, Pac-Man elevated "wocka-wocka" into the languages of several nations. And how well would those scores of space combat games have played sans the roar of hyperdrive or the (scientifically fallacious) deep space blowouts?

An inventory of basic sound effects is vital in the development of entertainment software. Players require some sort of audio cue which corresponds to the visual input. Even that most primitive of computer games, *Pong,* lives or dies by the single sound which provided the contest with its name.

"Sound effects are easy to handle on the C-64," explains Mark Lesser, a programmer and partner in MicroSmith. "The SID chip contains a number of sounds and possible sounds. You have to issue the command, and the sound is produced.

THE BEST SOUNDS IN ENTERTAINMENT

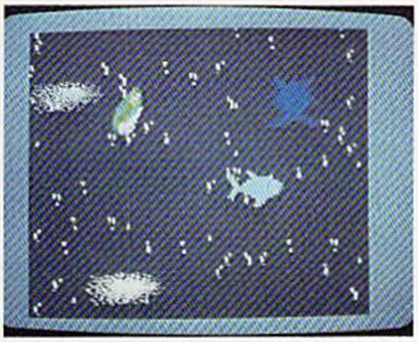
Which Commodore games have the best C-64 audio? Here are some of the editorial staff's favorites:

• *Ballblazer* (Epyx) is Lucasfilm's sport of the future. The rotofoils race up and down the checkered playfield to the accompaniment of the most pulse-pounding score in computer game history. Just try to remain unexcited while listening to this!

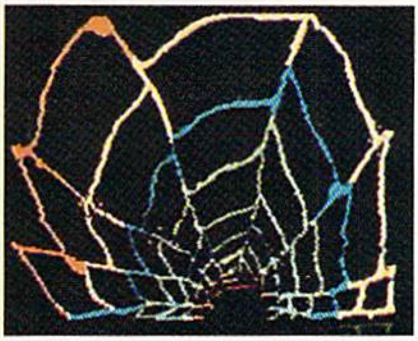
• *The Dolphin's Rune* (Mindscape) ranks as one of the most unusual computer games ever produced. Subtitled "A Poetic Odyssey," this John O'Neill program puts the user inside a dolphin's skin. The wild compendium of clicks, whistles, and otherworldly underwater audio is a real mood-setter.

• *GameMaker* (Activision) makes game design a realistic option for everyone. The system breaks up the design and programming process into animation (SpriteMaker), painting (SceneMaker), music (MusicMaker), sound effects (SoundMaker), and editor modules. It's an excellent tutorial for those interested in seeing how the Commodore 64 really works.

• *Web Dimension* (Activision), Rus-



Dolphin's Rune: *otherworldly audio.*
READER SERVICE NO. 213



Web Dimension: *surreal music journey.*
READER SERVICE NO. 214

This is obviously an efficient system, but it isn't very flexible."

Music, on the other hand, represents a much greater challenge. While designers sometimes dropped fillips of familiar tunes into computer games in the late 1970s and early 1980s, few programmers possessed the talent or inclination to write sophisticated music for game software.

The difficulties associated with composing music for game software are largely technological.

"Creating music for computer software involves using what are called 'interrupts'," explains Mark Lesser. "And the more interrupts, the better the music."

Creating music on computers involves generating waveforms. The more interrupts, the higher the resolution on those waveforms and the better the sound.

"You just can't produce quality music with rapid interrupts, and those interrupts do tend to degrade the onscreen action," says Lesser. "It's not hard when you're dealing with simple tones, but if you want to do fancy music or effects you have a problem.

"The SID chip does better at music than, say, the Atari ST, which uses the same chip as the old Mattel Intellivision," states Lesser. "The SID chip has a better choice of waveforms, and that's what determines sound quality."

The ability to produce quality music on micros had a significant effect on overall design philosophy. It became standard practice to open games with a title screen, credits, and a theme song. This practice of "setting up" an entertainment product as though it were a movie has spearheaded the new trend toward cinematic software. Games such as *Rescue On Fractalus* (Epyx) and *Karateka* (Broderbund) use music in a way which is highly analagous to motion pictures. (See sidebar, *The Best Sounds in Entertainment*).

Savvy game designers realize the potential of music to enhance the gaming experience. In *Spelunker* (Broderbund), for example, the gentle, plunking theme establishes the game's play speed, or pulse, while artfully evoking the proper atmosphere. *Ballblazer* (Epyx) also employs music to dictate its frenetic pace. The tempo is throbbing and insistent, the tone is electronic sci-fi, and the result is a game that has the power to enthrall all the senses, not just the eyes.

The quality of music on the C-64 has tempted designers to develop games oriented largely around sound and music. Titles such as *Web Dimension* (Activision) and *Master of the Lamps* (Activision) focus the player's attention with delightful original musical compositions.

The final component of computer audio, speech, has not come quite so far. Although some programs, like *Impossible Mission* (Epyx) and *Ghostbusters* (Activision) incorporate a limited amount of synthetic speech, its use to date must be called superficial.

The major problem with speech synthesis on the C-64 is the fact that it uses up great quantities of RAM. Most designers recoil at the prospect of "squandering" precious memory on what is, at best, a frill.

Very few games actually integrate speech into the action to any extent. Even arcade machines, which can secrete a tape recorder in the cabinet, seldom have had anything significant to say for themselves.

Speech can be programmed in several ways. Perhaps the most popular method involves speaking the chosen words into a tape recorder, then feeding that directly onto disk.

Some of the most successful examples of computer speech on the Commodore are found in *Impossible Mission* ("Thtay a while," a voice lisps in its best Karloffian fashion, "Thtay forEVER!") and *Ghostbusters* ("He slimed me!").

The very fact that these are the most prominent examples provides an insight into how rare significant speech really is in terms of contemporary software.

The increased memory capacity of newer-model microcomputers will certainly have a profound effect on speech synthesis in forthcoming game

sell Lieblich's musical journey through a surreal C-64 cosmos, doesn't have much action, but you'll never hear better music on any 8-bit computer.

• *Master of the Lamps* (Activision) features Lieblich again, this time working with Peter Kaminski. A two-phase game featuring some of the wildest steering sequences ever put on the gaming screen, it's a freaked-out trip to the limits of computer sight and sound.

The gamer helps a young prince prove his worthiness to rule. It's more of a game than *Web Dimension*, but equally impressive in terms of its stunning sound and graphics.

• *Moondust* (Creative Software) is not really a game at all. It's a free-form experiential program in which moving an onscreen cursor generates a wide range of musical sounds. Groovy psychedelic stuff.

• *Rescue on Fractalus* (Epyx) is as close as it gets to a George Lucas movie on computer. And part of that all-encompassing ambience is its pseudo-John Williams heroic score!

• *Spelunker* (Broderbund) has an enchanting theme song which sets the mood perfectly. The sound lends an air of mystery and excitement to this enthralling journey through an underground cave system.

software. But the real advances may wind up coming from another direction: educational software, especially language programs, where intonation is so vital to the learning experience.

Meaningful changes in computer audio will continue to depend upon advances in the hardware. "For sound to really work," says Mark Lesser, "it's got to be handled by the hardware."

The Amiga, with its digital sound (see sidebar), may well be the next big step. "It's a quantum leap," insists Activision designer/musician Russell Lieblich, the man who created the music for *Web Dimension* and *Master of the Lamps*. "This will be true digital audio. All of a sudden, we're talking about your computer sounding like a radio!" And at that point, Lieblich predicts, the weak link in the sound generating system will be the speakers through which the sound is heard.

Sound effects, music, and speech will continue to advance with hardware innovations.

As the always enthusiastic Lieblich put it so well: "I have heard the future—and it sounds better all the time!"

AMIGA: BREAKING THE SOUND BARRIER

Want to get excited about the Commodore Amiga? Talk to a designer who's worked on the system, or who'd like to. And that should cover just about every designer and programmer in the business.

"This will be true digital audio!" exults Activision computer maestro Russell Lieblich. "The Amiga can create a 'musical emulator.' In other words, you play an electric guitar into it and the computer 'remembers' the sound perfectly. That sound is digitized and can be played back at any pitch. This is real digital synthesis!"

Just as exciting to designers is the fact that sound does not interfere with other Amiga processing. "The Amiga has busses," explains MicroSmith's Mark Lesser, "which assign different periods of time to different functions. So producing sound doesn't interfere with the other functions," such as cursor movement and sprite animation.

The Amiga is also a delight for those who dote on speech synthesis. "Speech is resident in the Amiga," explains MicroSmith's Amiga master Charles Heath. A simple "Say" command allows the Amiga to generate phonetic speech.

The level of sound sophistication this can bring to entertainment software on the Amiga is mind-boggling. In *One-On-One* (Electronic Arts), for example, the basketball bouncing on the hardwood floor sounds...exactly like a basketball bouncing on a hardwood floor! Moreover, the background sounds are exactly the sort one would hear at an actual arena. As Dr. J and Larry Bird go through their antics, the hubbub of the crowd, the snatches of conversation, the calls of roving vendors fill the air.

Until one listens to the Amiga, it is difficult to imagine how much its improved sound capability adds to the gaming experience.

But don't believe us; ask a programmer.

LORDS OF CONQUEST
Electronic Arts
Commodore 64
Disk; $32.95

Territorial struggle has been a popular theme for games from *Go* to *Diplomacy* and *Risk*. It seems that many outwardly pacifistic people secretly nurture the dream of conquering the known world.

Lords of Conquest lets one to four computerists vent these imperialistic impulses. Participants use economic development, military force, and subtle negotiation to expand from the homeland territories to a position of supremacy.

Eon Software, authors of *Lords of Conquest*, has produced non-electronic board games for the last 15 years. The company's first major computer title shows the same design excellence as its now-classic *Cosmic Encounter*.

Unlike other board game design teams which have tried to chip off a piece of the electronic entertainment market, Eon eagerly embraces the medium and capitalizes on its capabilities. *Lords of Conquest* is more than a board game transferred to a monitor. This design would be impossible without silicon technology. For instance, the disk includes a library of 20 different mapboards and an easy-to-use system to concoct customized playfields. So when the strategic possibilities of a particular map seem exhausted, a switch to a new one breathes fresh life into the contest.

Another plus is, of course, the availability of computer-directed opposition. A full-blown session of *Diplomacy* requires a cast of seven, but *Lords of Conquest* is reasonably playable even solitaire. The user can choose from nine different difficulty settings prior to the start of play.

Another option unavailable except on a micro is the chance adjustment. The "low chance" game decides all battles strictly on the basis of strength. The stronger force prevails, and the attacker gets the benefit of ties. Horses, a vital resource, appear randomly.

The "medium chance" version randomizes production, trade, and shipping. Chance decides battles between equal forces.

The revised combat system for the "high chance" option introduces an odds system. The greater the superiority of the attacker, the greater the chance for a successful assault, but the numerically inferior side can still win any fight with a bit of luck.

The game can be played at four levels of complexity. The easiest utilizes only two types of resources, gold and horses. The higher settings introduce more different resources, allow the building of boats, and permit shipment of material from territory to territory.

Each turn represents a year of real time. Turns are subdivided into five phases: Development (for building cities and weapons), Trading (interplayer diplomacy), Shipment (transfers of resources and forces), and Conquest (warfare).

Players grow more powerful as they seize territories and gain the benefit of the resources they possess. A country can build a city in exchange for one unit each of gold, iron, coal, and timber. The first nation to erect three cities and defend



Lords of Conquest: ***best with humans.***
READER SERVICE NO. 219

them against attack for a year is the winner.

Lords of Conquest is most fun with live opponents, because diplomacy is the most exciting phase of the game. Much of the excitement comes from skillful trading with other players, deals which put potential allies at your side when the weapons come out later.

Other programs may sport fancier graphics or audio, but few can compare to *Lords of Conquest* as an electronic game. This is one to play, treasure, and then play again.

Electronic Arts, 1820 Gateway Dr., San Mateo, CA 94404 (phone: 415-571-7171). *–Arnie Katz*

ALTER EGO
Activision
Commodore 64
Disk; $49.95

Most computer games offer high-impact, visceral entertainment. They may be good, or they may be bad, but they rarely provide a lot of food for thought. No one is making a judgment; computer games are mentally and physically stimulating fun, even if they don't often promote self-examination.

Still, a computer entertainment with significant intellectual content is rare enough to be worthy of attention. And when insightful thoughts are presented with wit, charm, and humor, the program is worthy of our applause. So let's hear a big hand for Dr. Peter J. Favaro, the creator of *Alter Ego.*

The object of this semi-role-playing recreation is to take a character through the seven stages of life: birth & infancy, childhood, adolescence, young adulthood, adulthood, middle adulthood, and old age. The program establishes starting parameters for the newborn either randomly or by analyzing the participant's answers to a short psychological test which the program administers prior to the start of actual play.

The joystick or the arrow keys allow the user to select one of the rectangular icons from the center of the display. Each drawing represents a social, intellectual, emotional, physical, familial, or vocational life experience.

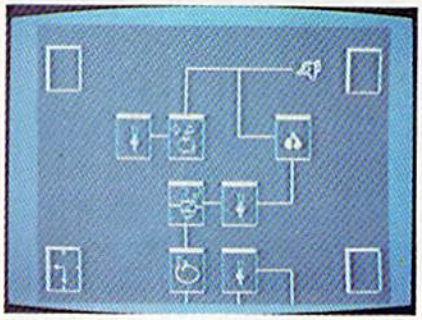
Selection of an icon thrusts the player into an interactive scene based on one possible event in life. Successive display screens outline the situation in a breezy narrative style. Menus offer possible modes of player response. If the computerist wishes to leave an episode before it's over, pressing RUN STOP returns the cursor to the main display.

The character of the alter ego develops as an outgrowth of its life experience. The program quickly detects the frivolous player and delivers onscreen admonishments after behavior it considers out of character.

Although the instruction manual disclaims any clinical value for *Alter Ego,* the vignettes are the result of hundreds of interviews with men and women. To insure that all episodes are as germane as possible to the player, Dr. Favaro has written "Male" and "Female" editions of *Alter Ego.*

Life Choice and Status icons flank the life experience symbols on both sides. Activating the Status icon produces a report on how the character is doing in 12 personality traits: calmness, confidence, expressiveness, familial, gentleness, happiness, intellectual, physical, social, thoughtfulness, trustworthiness, and vocational.

Characters age in *Alter Ego* as in real life. The alter ego automatically moves along to the next stage of life when he or she attains the required age. Many experiences require specific prerequisites. For instance, you can't send your game-surrogate to college without first securing a high school diploma.



Alter Ego: ***genuine food for thought.***
READER SERVICE NO. 220

Life Choices are life's landmarks, pivotal points which strongly shape personality. They include high school, high-risk adventures, relationships, work, school, major purchases, marriage, and raising a family. A player can repeatedly pick the same Life Choice icon, getting a series of different episodes, to strengthen a character trait which has previously shown sluggish growth.

The gamer can try as many icons as desired in any order within a life stage until the program forces him or her to progress to the next stage. A Life Choice icon's supply of episodes can run dry, but there are enough to satisfy the demands of most jaunts through the Seven Ages of Man.

Tracks connect clusters of icons, but this serves absolutely no purpose in the Commodore edition of the game. Versions of *Alter Ego* for some other systems force the participant to follow the lines, producing a "road of life" effect, but this aspect is totally absent from the C-64 product. That's a shame, because the freedom to choose any icon on the field in any order removes the need to make strategic choices.

The documentation is not as good as it is long. The manual makes a lot of silly statements about *Alter Ego,* not the least of which is terming it a "fantasy role-playing game," but fails to provide much real insight into this program.

Memory limitations keep *Alter Ego* from being a total success. It is good for a couple of runs per person, and then it becomes increasingly repetitive and predictable. But if the quality of your computer entertainment is more important than the number of





Pinko moralizing takes a back seat to blood and guts action in Nam, *incorporating six battle scenarios.* *READER SERVICE NO. 221*

hours it keeps you at the computer, *Alter Ego* is guaranteed to provoke private contemplation and public discussions. This is fun for the thinking gamer.

Activision, 2350 Bayshore Frontage Road, Mountain View, CA 94043 (phone: 415-960-0410). *–Arnie Katz*

NAM
Strategic Simulations
Commodore 64
Disk; $39.95

The hawks and doves of the 1960s and 1970s may find it hard to believe, but Vietnam has finally moved from the newspapers to the history books. Time has cooled the once-burning passions which threatened to rip the country in half. The perspective of a decade of peace makes it possible for contemporary Americans to view the event with a degree of detachment.

The publication of *Nam* is one piece of evidence which supports this contention. It is doubtful that a major publisher like Strategic Simulations would have marketed a military simulation on this topic as recently as five years ago.

Designer Roger Damon has elected to focus exclusively on armed conflict. Those who want a game which takes economic, social, and political aspects of the situation into account must look elsewhere; this title chronicles the actual fighting, the blood and the bullets. The six scenarios included on the reverse side of the disk cover a variety of armed encounters during the 1966-1968 period.

The six mini-games run the gamut from a "search and destroy" mission to a tricky assault on an underground enemy cave network. Each scenario can be played using a historical setup or a hypothetical one. If the player chooses the latter option, the program randomly selects one of two possible setups.

The battles are 10-25 turns long. A computerist can save a game in progress for resumption at a later date, though this procedure requires a formatted Commodore disk.

There are four levels of victory in *Nam,* ranging from questionable to decisive. The program reports the level of victory at the end of the game, based on the number of units each side has lost and, in some cases, for achieving objectives like wiping the enemy off the map or saving trucks from destruction. All special goals are enumerated in the scenario descriptions. The program also prints a running tally of each army's casualties at the conclusion of every turn.

Nam is a solitaire simulation in which the human player always commands the American troops against the computer-controlled Viet Cong. Hidden movement, which keeps enemy units off the board until they move or engage in fighting, produces the authentic feel of "the fog of war." Sometimes, the toughest part of an action is finding the guys on the other side, before they give your units a nasty surprise.

As in most wargames, turns in *Nam* are segmented into phases. Hitting the "f7" key allows the game to progress from one phase to the next. The fact that both sides get two chances to order fire in each turn, coupled with rules which allow the enemy to direct defensive fire at your units as they execute movement, keeps the action very lively. The fighting can really get heated during some of the scenarios, such as the ambush of a U.S. truck convoy.

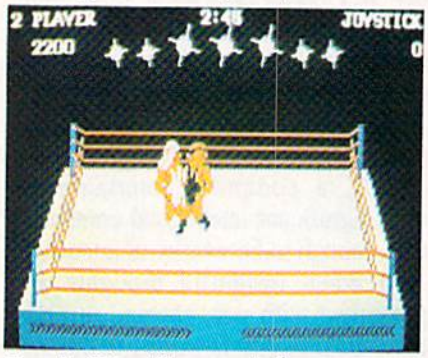
The documentation is excellent, which will hardly surprise computerists already familiar with SSI's extensive line of military simulations. Besides a lucid explanation of all major rules, the 20-page booklet also contains a map for each battle, a catalog of unit types and weaponry under the player's command, design notes which comment on each scenario, and a brief section of genuinely helpful hints on strategy. The tips can save hours of frustration for those who aren't conversant with the unique features of the Vietnam conflict.

Computer wargamers who want a real change from World War II tank battles and Civil War cavalry charges should try *Nam.* The situations it presents are a fresh challenge for those who feel they have mastered the essentials of more conventional military conflicts.

Strategic Simulations, Inc., 883 Steirlin Road, Building A-200, Mountain View, CA (phone: 415-964-1200). *–Steve Davidson*

BOP'N WRESTLING
Mindscape
Commodore 64
Disk; $29.95

Promoters bragged that Wrestlemania 2, last spring's mat extravaganza, was what "the whole world is coming to." Actually, they weren't ex-



Bop 'n Wrestling: *varied maneuvers.*
READER SERVICE NO. 222

aggerating by much. America is the mecca for this blend of sports and entertainment, but the grunt-and-groaners also draw huge crowds in such far

away places as Australia, Kuwait, and France.

Mindscape proves that mat madness is truly a worldwide phenomenon with the release of *Bop'n Wrestling.* Although this action-strategy program was created in the United Kingdom by Melbourne House for Beam Software, its features and nuances are instantly recognizable to anyone who has ever cheered when Hulk Hogan rips off his muscle shirt.

In the one-player mode, the computerist uses the joystick or keyboard to put Gorgeous Greg through his paces. The blond hero, who starts from the lower right corner of the well-rendered three-dimensional ring, must defeat nine challengers in a series of one-fall matches. If Greg vanquishes all challengers, he attains the top rung on the grappling ladder—the world championship.

When two gamers compete head-to-head, the winner must take two out of three falls before the bout's time limit, as shown by the onscreen countdown clock, elapses. Participants can elect to manage any of the 10 wrestlers prior to the start of the match.

The personalities of the game's matmen are derived from traditional ring stereotypes. Examples: Bad Barney Trouble is a vicious masked man from Parts Unknown, Lord Toff wants to restore the British Empire, and Redneck McCoy is a country boy who wants to destroy "citified" wrestlers with his atomic drop. Other competitors are Flying Eagle, Vicious Vivian, Missouri Breaker, L.A. Bob, Angry Abdul, and Molatov Mike.

Except for Gorgeous Greg, all grapplers are essentially villains, though Lord Toff is said to be cruel but scientific. Some personas may jar fans of "real" American wrestling. Indians and hillbillies are usually crowd-pleasers in this country.

A more serious problem is the complex control system. The meaning of any given joystick movement or keystroke depends on the relative positions of the two fighters inside the squared circle. If your man has his opponent in a front headlock, pushing the joystick to the left while pressing the button causes a reverse suplex. If the user employs the same controller movement when the foe is lying on the canvas, it produces an elbow drop.

The range of possible maneuvers is even more extensive than the cast of wrestlers. The gamer can initiate two dozen different holds. These are: airplane spin, armspin, arm twist, atomic drop, back breaker, body slam, clothesline, drop kick, elbow drop, flying body press, forearm smash, full nelson, head butt, headlock, kick, knee drop, knee strike, mad charge, pile driver, pin, reverse suplex, stump, suplex, and turnbuckle fly.

Don't worry if some of the moves are unfamiliar. The 12-page instruction booklet, though agonizingly sketchy about other details, provides a complete glossary of wrestling holds.

The documentation provides schematic diagrams which show how to perform each hold. That helps, but most players will need plenty of practice before they can execute maneuvers crisply in real time. The computerist should spar with a stationary opponent in the two-player mode to develop the necessary quickness.

Even with study, *Bop'n Wrestling* may prove too hard for some, especially those who have lost a fraction of speed to the aging process. Including so many maneuvers in the game is a laudable achievement, but gamers may become momentarily disoriented when both wrestlers are whizzing around the ring. Even learning to move a grappler around the ring accurately can be a challenge.

This problem aside, *Bop'n Wrestling* is totally charming and highly entertaining. Its cartoon-style graphics, excellent theme music, and true-to-life sound effects make the gamer feel every slam and smash.

While this program isn't championship caliber, it's indisputably in the main event class. *Bop'n Wrestling* delivers hours of mat mayhem with enough strategic scope to make it worth playing again and again.

Mindscape, 3444 Dundee Road, Northbrook, IL 60062 (phone: 312-480-7667). —Arnie Katz

TRAPPED

For the C-64

By Mike Hoyt

In an effort to colonize other solar systems, the scientists of earth have created a beam able to transport matter at the speed of light. You have been selected from a group of highly skilled space explorers to test the experimental device. You are equipped with a multishielded probe to protect your ship from damage during the matter transportation.

The experiment is going well until the master computer fails, and your probe is flung from the light beam and hurled into an unknown galaxy. Here, the "planets" are actually hexagonal shapes linked together and patrolled by aggressive alien creatures. You can avoid these alien menaces by jumping your probe from hexagon to hexagon. The touch of your probe destroys the hexagon it touches. Destroy all the hexagons and you can escape to the next planet.

After you enter the program, type RUN and you will be presented with a title screen. Select the starting level and the number of shields you want by pressing the f1 and f3 keys, respectively. Levels 1 through 10 require each hexagon to be touched once, while levels 11 through 20 require each hexagon to be touched twice. When you're ready to begin, press f5.

The starting level you selected will be displayed on the screen. A countdown will begin, giving you time to get ready. Use a joystick in Port 2 to move your probe around the screen, avoiding places where hexagons don't exist.

If the alien is giving you too much trouble, pilot your probe onto the white square, which will instantly teleport your ship to a random position on the planet. However, it can only be used once and may teleport your ship directly on top of the alien you were trying to avoid.

To pause the game, just press the SHIFT LOCK key. This will cause the game to stop until the SHIFT LOCK key is pressed again. □

SEE PROGRAM LISTING ON PAGE 109



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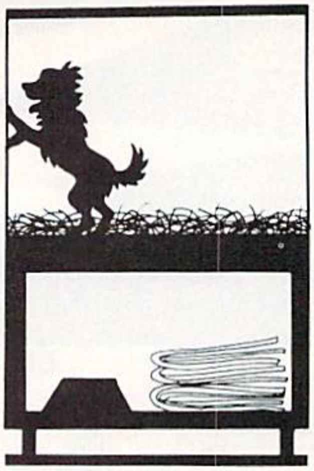
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DOGCATCHER

For the C-64

By Bob Blackmer



Dogcatcher is a colorful arcade game for the Commodore 64, written entirely in machine language.

The characters in this game are a pack of pesky canines with shiny white teeth and Dash Dolittle, the dogcatcher. Dash also drives a truck to advance to the next level.

When the game starts, the truck backs in and Dash appears behind the truck. He is safe from the dogs at this point; as everyone knows, a dog would never run down a street with the dogcatcher's truck on it!

The idea behind the game is to dash around the neighborhood streets capturing dogs and taking them to your truck and advancing to the next neighborhood, where the pace of the dogs will be faster. You'll start out with nine lives (pun intended), and will receive 100 points for each dog put in the truck. On the right side of the screen is displayed the game information: score, dogs captured, level, and lives left.

To catch a dog you must be facing him, and at the right moment press the fire button to throw down your net. You cannot run a dog down from behind to catch it. If you press the fire button too early, you might not be able to get your net down again fast enough to avoid being bitten.

If you are successful at capturing a dog, the dogcatcher "freezes" with a dog in his net. He will be facing the right side of the screen so he can deposit the dog in the truck.

At any other time a dog comes in contact with Dash, Dash is bitten, loses a life, and is sent back to the truck. You must be careful after catching a dog to make your way back to the truck without any contact with a dog. To put a dog in the truck, just touch your net to the back of the truck. You are then ready to get another dog. After catching and depositing the last dog in the truck, it drives off filled with dogs to take to the pound. The empty truck then drives back onto the screen and Dash can then clear another neighborhood of runaway dogs.

Rather than incorporate sound effects for the dogs and dogcatcher, I opted for a musical soundtrack which plays in the background of the game (I'm sure you'll recognize the tune).

I'll give you one tip, which will help on the later levels when the dogs' pace is quick. As Dash runs back and forth across the screen, you'll notice the different shapes that make up Dash. The best position to be in is when his legs are straight, giving you more room to catch the dog before he can bite your leg.

Dogcatcher must be entered using *Flankspeed* (see page 89). After typing *Dogcatcher* in and saving it to disk, reset the computer and LOAD "DOGCATCHER",8,1. Type SYS 49152 to start. ☐

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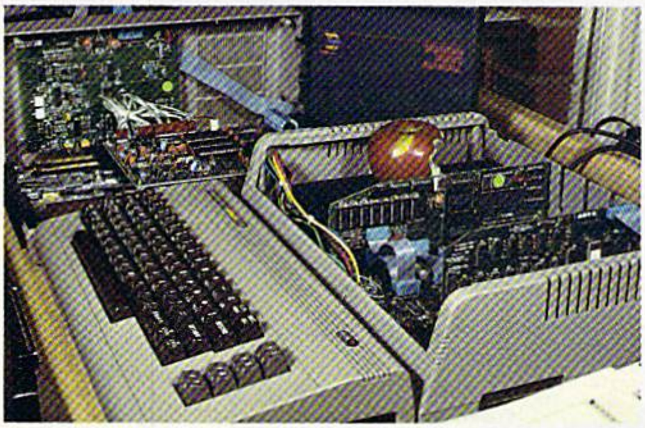
THE SPARTAN
Mimic Systems, Inc.
Commodore 64
Price: $299

After being heavily advertised for over two years, the Spartan from Mimic Systems seemed destined to become the longest recorded case of vaporware in microcomputing history. It lost its chance at this dubious distinction in May when, to our surprise, a prototype of the Spartan arrived in our New York offices for review. What turned out to be an even greater surprise was that the darned thing actually worked! This was no mean feat considering the number of distinct pieces of hardware which had to be fitted together.

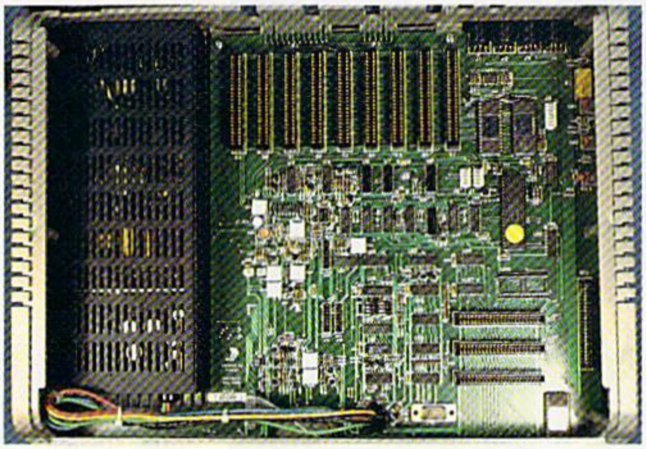
However, we seem to be getting ahead of ourselves. For those of you who may have just come on board the ship of Commodore computing, or for those individuals who missed Mimic Systems' full page color ads in nearly every issue of *Ahoy!* through last November, we state the following: The Spartan is a hardware device which bestows upon your Commodore 64 the ability to emulate an Apple II+ microcomputer. Note that we said II+ and not IIe or IIc. The Spartan is not designed to provide the extended features of these later models.

So what's this, we hear you say? Why should anyone running a C-64 be interested in an itinerant fruit machine? Don't we C-64 users already enjoy access to possibly the largest library of quality software available for any microcomputer?

To these skeptics in our audience we simply say that it is not our intent to indulge in philosophical discourse, nor will we attempt to influence anyone's religious beliefs. We will merely present the facts as they are. After all, our ears still ring from those plaintive cries of fledgling C-64ers: "Is there any way to run Apple software on my computer?" (We have occasionally heard the opposite motif emanating from many a fruity source.) Besides, at the new price of $299, the Spartan sure offers a lot of fancy hardware.



Top: inside the Spartan, with the CPU and Apple drive cards installed. The 1541 shows the custom DOS card installed.



Bottom: bird's-eye view of interior. To the left is the power supply. The main circuit board, or BUSS Card, displays its array of Apple peripheral slots at the back (top) and three C-64 internal expansion ports at the front (bottom) right. The large chip with the yellow dot (center right) is the custom communication chip.

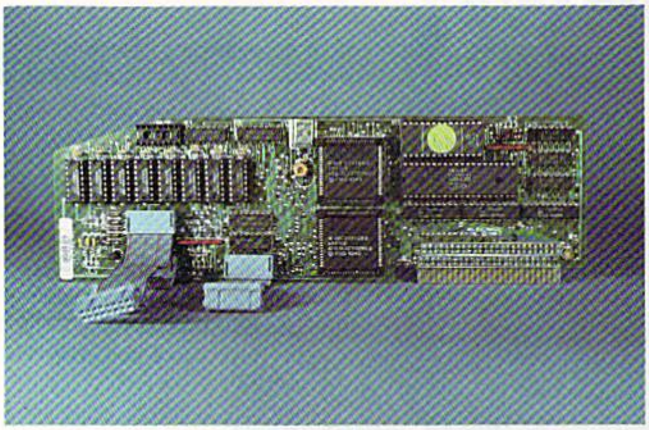
PHOTOS BY MORTON KEVELSON

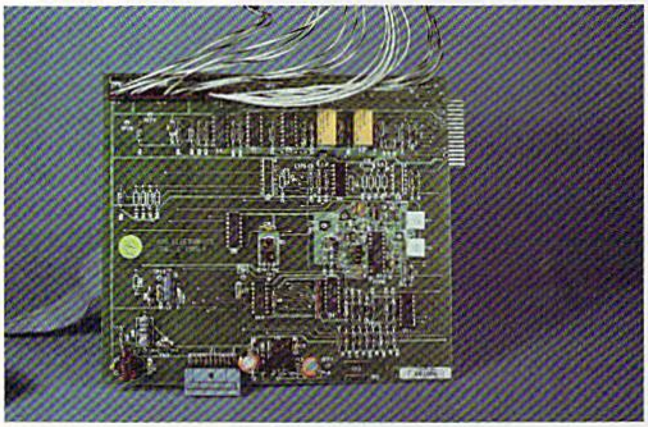
The Hardware

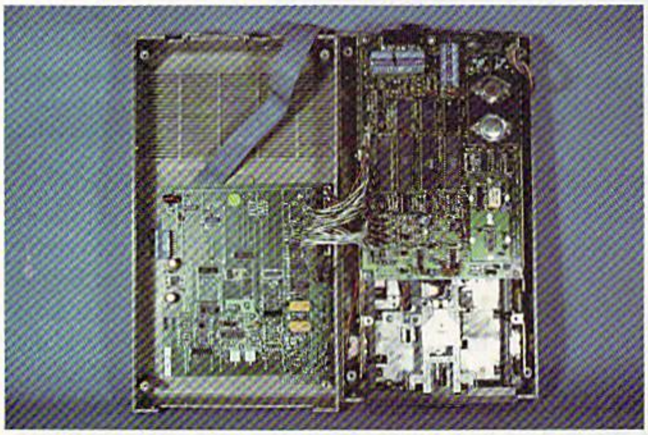
When it comes to hardware, the Spartan definitely sports some unique features among its several components. The heart of the system is a boxy looking affair styled very much like the C-64. In fact, once installed, the Spartan seems to fit naturally in place. This 12" deep by nearly 5" high C-64-gray plastic container is exactly the same width as the 64. The top surface of the box, which is easily removable to allow for internal access, is the right size and of sufficient structural strength to support a 1702 color monitor. Inside the box is the system's main circuit board, or BUSS Card, and a 60 watt peak switching power supply. Mating the Spartan to the C-64 is straightforward—just gently ram the Spartan into nearly every orifice in the back of the C-64.

The BUSS Card itself has rigidly positioned mating connectors for the C-64's user, cassette, and expansion ports. Flexible hookup cables are provided for the serial and video ports. The only port left unmolested is the television connector, for which you optionally install the cable originally supplied with the C-64. Once mated, the various and sundry connections seem to create a remarkably firm union.

The top lid of the main enclosure is easily removed to reveal a very Applelike environment. The most obvious feature of the enclosed BUSS Card is a row of nine edge card connectors (known as slots in the Apple world) suitable for standard Apple peripheral cards. As the Apple experts in our audience know, Apples are normally equipped with only







Top: the heart of the Spartan is its CPU card. The large rectangular chip is the 6502 microprocessor running at one megahertz. The eight kilobyte ROM is identified by the green dot. The two multipin square chips are custom LSIs. The upper performs the Spartan's video management. The lower handles memory management. Eight socketed, 64 kilobit dynamic RAM chips comprise the Spartan's memory. The empty socket is for expansion ROM.

Middle: The 1541 disk drive's custom DOS card, which turns the 1541 into an Apple-compatible drive.

Bottom: The 1541 with the custom DOS card installed.

eight slots.

The leftmost connector, designated as Slot A, is reserved for the Spartan's CPU card. The CPU card contains its own 6502 microprocessor (running at 1 megahertz), 64 kilobytes of RAM, 8 kilobytes of ROM, and a collection of support components. Among these chips are a pair of Mimic Systems' proprietary LSIs. These handle the video and memory management of the system.

The remaining slots (0 through 7) are for use with various and sundry Apple peripheral cards. One of these slots will be immediately filled by an Apple disk controller card. This card, included with the Spartan package, is needed to control the Apple disk drives. The one provided with our unit was made by Micro-Sci, a well-known supplier of Apple peripherals. As a rule, Apple disk controller cards can each handle up to two disk drives.

As with the C-64, the bulk of Apple software is disk-based. If you haven't guessed it by now, the Apple disk format is as unique as the Commodore disk format in the microcomputing world. This means that Commodore disk drives and Apple disk drives cannot read disks which were formatted for each other's system, right? Wrong! Mimic Systems was not about to let trivial obstacles of this sort stand in their way.

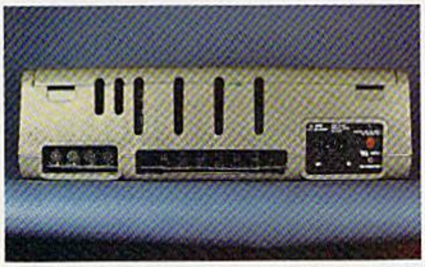
An essential part of the Spartan package is a specialized DOS card which installs in the 1541 disk drive. The installation is somewhat cumbersome. The drive's cover and internal RFI shield are removed. The DOS card is installed in the top of the drive cover, where it is held in place by four sticky feet. Next the 1541's connectors to the drive's motors and write protect sensing circuits are transferred to the DOS card. A supplemental set of jumper cables are then used to reconnect the 1541's connectors to an alternative set of pins on the DOS card. After all this, the drive cover is supposed to be remounted on the disk drive.

We decided not to take a chance on this last operation. The wires making up the jumpers on our sample were of a heavier gauge than what is usually employed for this application. This was apparently due to a mixup in the hardware specification of the early units. We decided to operate the drive with its cover standing to the side.

Getting back to the Spartan's BUSS Card, we noticed numerous jumpers, connectors, and test points scattered about. Unfortunately the preliminary manual with our system did not contain the information needed to properly identify these parts. A far more detailed technical manual for the Spartan is in the works.

We did manage to locate the Spartan's firmware in ROM. The biggest chunk consists of a 16 kilobyte system ROM which contains a clone version of Apple floating point BASIC, monitor, and autoboot routines. This package was written for the Spartan by Central Point Software, a major developer of Apple programs. Alongside is an eight kilobyte Spartan Phantom ROM which presumably handles the C-64 communications on the Apple side of the setup. There is also a corresponding eight kilobytes of C-64 ROM for the





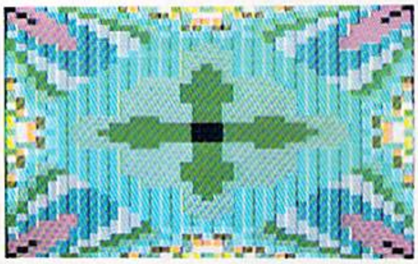


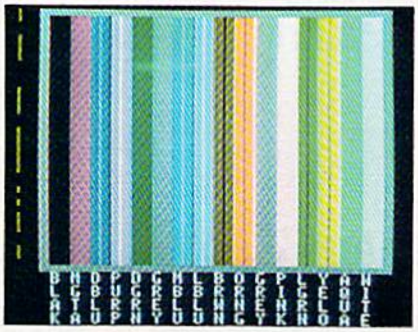
Top: front view of Spartan. Middle: back view, showing four DIN connectors, extensions to the C-64's cassette and user ports, power connector, and on/off switch. Vertical slots are to permit exit of Apple peripheral card cables. Bottom: right side, sporting fourth cartridge slot and three reset pushbuttons.

C-64 side of things.

It is worth noting that the Apple disk operating system (DOS) must be loaded from disk into 12 kilobytes of the system's RAM. The task of controlling the drives falls to the 6502 microprocessor in the computer. By comparison, the Commodore disk drives have their DOS in ROM and their own 6502 microprocessor. The C-64 merely issues instructions to the drive which then takes virtually independent action.

The second most obvious piece of territory on the BUSS Card is the collection of no fewer than three C-64 cartridge connectors at the front right corner of the board. A close look reveals a fourth cartridge connector extending through the right side of the case. The Spartan lets you install up to four C-64 cartridges at once. Any one of these may be selected and initialized directly from the C-64's keyboard.





Top: Spartan display of the kaleidoscope program included on the Apple DOS 3.3 disk (not included). Bottom: the Apple II+'s seven colors à la Spartan.

Right above these slots is an empty integrated circuit socket. This is intended for a custom ROM chip to act as a replacement for the Spartan's built-in 8K Phantom C-64 startup ROM. In effect, this represents a fifth (or sixth) C-64 cartridge position. Selection between this socket and the Phantom ROM is via internal jumpers.

The Spartan's rear panel is quite busy territory. There is the usual power connector and on/off switch. (When will microcomputer manufacturers learn to locate power switches where we can reach them?) The C-64 cassette port is also brought out to the back panel, along with the C-64's user port. The Spartan may be set to use a Commodore cassette recorder to save and load Apple programs. The standard audio jacks, which are present on the Apple II+ for cassette use, are not in the Spartan. However, there is a row of test pins on the BUSS Card which may be fitted with an audio adapter. This accessory is available separately from Mimic Systems.

Off to the side is a row of four circular DIN jacks. The outermost jack carries through the C-64's audio and video signals. This lets you hook up a separate, optional monitor dedicated to what's on the C-64 display screen. The next jack is the Commodore serial port for disk drives, printers, and other serial bus peripherals. The C-64 power supply plugs into the next jack. Only the nine volts AC from this supply is used, as the C-64's five volt power is supplied from the Spartan's built-in supply. The innermost DIN jack outputs mixed audio and video from both the C-64 and the Spartan. The significance of this last feature will be described in detail below.

The Spartan even adapts Atari- or C-64-type joysticks for use with Apple software. The Apple and Atari style joysticks are fundamentally different beasts. The former are of an analog design bearing a strong resemblance to a pair of mechanically cross-linked paddles. The latter are of a digital design composed of four normally open contacts which may be closed singly or in pairs by moving the stick diagonally. Thus Apple joysticks may be used to impart quantitative as well as qualitative information.

In practice most games utilize only the directional information imparted by the Apple joystick. For these applications the Atari style joystick may be successfully substituted. The only limitation is that Atari style joysticks have only one fire button to the Apple's two. The Spartan's BUSS Card is equipped with a standard nine-pin game connector. This connector is activated by installing a short jumper between the CPU and the BUSS Card.

Aside from the on/off switch, the only external controls on the Spartan (other than the C-64 keyboard itself) are a set of not one, not two, but three red reset pushbuttons all in a row on the right side. The rearmost of these is functionally equivalent to the RESET key on the Apple's keyboard. The middle button resets both the Spartan and the C-64 when it is running a cartridge-based program. The front button resets only the C-64.

What It All Means

The designers of the Spartan have exercised their ingenuity above and beyond the call of duty in designing the Spartan-to-64 interface. Numerous contingencies have been considered and accounted for. A closer look at the operation of the system is instructive.

The Spartan is a complete microcomputer lacking only a dedicated keyboard, which the C-64 provides. In fact the concept of using the C-64 as a keyboard is fairly easy to implement. The C-64's keyboard is normally scanned 60 times a second by the Commodore operating system. It does not require much effort to change the destination of any collected keystrokes. This means that for the most part neither the C-64 nor the Spartan need be terribly concerned about each other's presence.

As a result the two computers operate independently of each other. It is entirely possible to boot up and run an application on the Spartan, switch to C-64 mode, and load and run a Commodore program.

The operation of the system is guided by an 8 kilobyte C-64 Phantom ROM in the $8000 block of the C-64's memory space. As with any other C-64 cartridge, the Phantom ROM takes control of the computer on power up. The power up screen

FOR C-128 USERS:

We haven't tried this ourselves, but the Spartan may work with the C-128 as well. The physical ports may have to be modified slightly to insert the Spartan into the 128. It appears that the cassette port connector will have to be removed or bent out of the way, which means that the cassette access at the back of the Spartan will cease to exist. However, at this point, the connectors to the user port and expansion port should fit properly. The C-128 will then power up in C-64 mode and the Spartan should function as described in this report. The remaining problem is to figure out how to plug the C-128's square power connector into the Spartan's C-64-style round port. This boils down to the classic problem of inserting a square peg into a round hole.

may be either the Spartan or C-64 display, as selected by setting a jumper on the Spartan's BUSS Card. Regardless of the initial display, both computers go through their initializing routines when the power is turned on. Thus the Spartan's disk drive will whir and chatter and accept and run an Apple application even while the C-64 is busy displaying its opening message.

The primary function of the Phantom ROM is to determine which computer will receive the keyboard's output at any given time. The user selection controls are built into the C-64's function keys, which remain active in all modes. The most frequently used keys will be f2 and f4. The f2 key brings up the C-64 display and transfers the keyboard data to the Commodore 64. In this mode all C-64 functions may be performed. The f4 key returns the machine to Spartan mode, where the Apple takes over. The f6 key executes a C-64 reset, leaving the Phantom ROM mapped in. The f8 key resets the C-64 to its power up state without the Phantom ROM. This last function does not terminate the execution of any programs which may be running in the Spartan at this time. Finally the f1 key disables all the function key functions for one keypress. This lets you access the function keys for C-64 programs which use them.

If you use the Spartan's mixed video port, then the display will automatically switch between modes. It is also possible to obtain a permanent Commodore display by hooking up a second monitor to the C-64 video port on the rear panel.

If you do intend to multitask the Spartan by simultaneously running C-64 and Apple programs, keep in mind the following limitations on the C-64 side. Commercial programs which expect an unadorned C-64 will probably not run, since the Phantom ROM appears as a C-64 cartridge. Any programs which need to access the 8K of RAM starting at $8000 will probably not work. In general, C-64 programs written in BASIC should have no problems, as long as they make no demands on the aforementioned memory.

The Phantom ROM adds several commands to the C-64's BASIC. All of these are preceded by the ampersand or SHIFTed 6 keyboard character. A list of these commands, along with a brief description, may be obtained by entering &HELP. Most of the commands deal with the mutual hardware configuration between the two machines. In particular, functions regarding keyboard and video display setup are provided. It is also possible to divert data sent to a peripheral of one computer to the memory of the other computer. For example, the output of a Spartan word processor may be diverted to C-64 RAM instead of to an Apple printer. You will need a good command of both machines to properly implement these features.

Extensions specific to the C-64 include a built-in machine language monitor and control of the Spartan's built-in, four-slot C-64 cartridge BUSS. As we mentioned above, up to three C-64 cartridges may be installed inside the Spartan. A fourth cartridge may be plugged into the external slot on the right side of the machine. The &SELECT command chooses which cartridge will take effect when the &START command is issued or when the C-64 reset button is pressed. The only ways to change the selection are to reissue the &SELECT command or power down the system. The default cartridge on power up is always the Spartan's Phantom ROM.

Finally, if you would like to know who designed the Spartan, you may read the information molded on the inside of the Spartan's cover or issue the &CREDITS command from C-64 mode.

Spartan Mode

Operation in Spartan mode is virtually indistinguishable from the classic II+ fruit machine. The most notable difference is some minor adjustments to accommodate the keyboard discrepancies between the C-64 and the Apple. The left arrow key serves as the ESCape key. The DEL and left cursor keys duplicate the Apple's left

READER SERVICE INDEX

The publisher cannot assume responsibility for errors in the above listing.

arrow key and the right cursor key takes the place of the right arrow. The shifted CLR/HOME clears the screen, as does the Apple's ESC @ sequence.

The Spartan provides several enhancements to basic Apple mode. The most notable is the inclusion of both upper and lower case characters. The Commodore/Z keystroke toggles between upper case only and the full character set. In fact, nearly every letter key has assigned to it a Commodore logo key function. Most of these are BASIC keywords which start with the corresponding letter.

We will leave the description of most Apple-type functions to the various Apple books on the market. The Spartan is packaged with a copy of *The Elementary Apple* by William B. Sanders, published by Datamost. This book presents a thorough introduction to the Apple environment and the Applesoft BASIC programming language. The package also includes a copy of *The Flier* from Central Point Software, Inc., a general purpose Apple disk and copy utility program.

If you are totally unfamiliar with the Apple operating environment, you will be in for some surprises. For example, the Apple's modified line editor is decidedly primitive when compared to the C-64's full screen editor. Bit mapped graphics are readily available from Applesoft BASIC. However, the C-64 bit mapped hi-res and multicolor modes with sprites is a bit more versatile. Apple sound effects are for the most part limited to a series of grunts, squeals, and whistles from the Spartan's built-in loudspeaker by comparison to the sonorous overtones of the C-64's SID chip. Then again, the Apple is basically a holdover from 1977 or thereabouts. By comparison the C-64 is a starry-eyed newcomer.

Perhaps the key question on many of our minds is just how compatible is the Spartan with Apple II+ software. According to Mimic Systems, the Spartan is compatible with more than 90% of general applications but only 75% of the educational programs. An upgrade to the Spartan, which was on the way to our offices as we wrote this, should improve upon these figures.

Our own experience seemed to confirm these quantities. Most programs we tried ran without any problems. These included a collection of Apple games and the *Graphics Magician* and *The Illustrator* graphics programs. We did have considerable difficulty with most Apple disk copy programs. For example, the COPYA utility on the Apple DOS 3.3 system disk does not work. We also encountered some bugs in the BASIC interpreter. In particular the GET command returns a type mismatch error whenever it is used with a numeric variable. Mimic Systems is diligently logging in all user-reported Spartan quirks. If enough of these surface, an upgrade ROM will be issued.

Disk Operations

Mimic Systems strongly recommends a full disk drive alignment of any 1541s to be used with the Spartan. The primary purpose of this is to get the stepper motor pulley pinned to its shaft. The occasional disk drive head chatter brought about by disk formatting and early C-64 copy protection is a way of life for Apple disk drives. Every time the system is powered up the disk drive head is pulled back for some tentative raps. Apple disk errors result in a vigorous workout of the head mechanism. This sort of treatment is not likely to be tolerated by early versions of the 1541.

When running in Spartan mode, the disk drive is powered from the Spartan's own power supply. In fact, the 1541's own power cable may be left off if you will not be accessing C-64 mode. If you plug in the drive's power and hook up its serial bus cable, the same drive may be used for either Spartan or C-64 operation. Switching between the two systems is fully automatic. Just make sure the proper disk is in the drive corresponding to the current operating mode. Apple and Commodore will not tolerate each other's disk formats.

If you wish, an Apple-compatible disk drive may be substituted for a modified 1541. If you have an Apple drive, you can save $50 by ordering the Spartan without the 1541 DOS card. The Apple drive card will still be supplied.

Conclusions

Overall we were very favorably impressed by what the Spartan had to offer. The hardware certainly seemed well-designed, with enough googaws and gadgetry to gladden the hearts of many a hacker. The system is clearly designed with a totally open architecture. In this regard we are eagerly awaiting the final version manual so we can find out what all of the various little dingbats are all about.

The $299 price tag is reasonable enough in view of all that is being offered. It is certainly the least expensive way to get into Apple computing as of this writing. Compatibility with Apple hardware peripherals should be quite good, the only exceptions being those cards which connect up to points inside the Apple's circuitry. Software compatibility should also be good. However, we do recommend that you arrange to try before you buy any Apple programs for use on the Spartan.

In spite of its late introduction we expect the Spartan to be well-received by the Commodore community. We just wonder what Apple will make of all this.

US: Mimic Systems, Inc., 18027 Highway 99, Bldg. A–Suite I, Lynnwood, WA 98037 (phone: 1-800-663-8527).

Canada: 1609B Fort Street, Victoria, BC, V8R 1H8 Canada (phone: 1-800-663-8527). *—Morton Kevelson*

SUPER KIT/1541
Prism Software
Commodore 64
Disk; $29.95

After word processors, spreadsheets, and, of course, games, we find that disk copy utilities flourish where other software fails to survive. The reasons for the popularity of these reproductive entities are numerous, not the least of which is the primitive state of the duplicative software provided by Commodore with the 1541 disk drive. Although better than they used to be, the disk utilities on the 1541 are primitive at best and inadequate at worst.

Commercial copy programs, as a minimum, promise to give back to the user his congressionally granted right to at least one archival copy of his essential software. In fact, it is commercial copy protection's interference with the pursuit of everlasting redundancy that provides the very fertilizer nourishing the growth of the copy utilities.

Super Kit/1541 is supplied on a double sided (flippy) disk. The workhorse utilities are on the first side, with some of the more specialized material on the second. Most of the programs are accessed through a graphically impressive set of menus. These include graphic screens which fade into selection lists accompanied by some animated effects. When you tire of the flashy displays, you may access the programs directly through a special loading sequence.

The first pair of selections are single and dual drive versions of a high speed disk copier. *Super Kit* refers to to these as the "Normal" copiers. In this case normalcy has been extended to include the reproduction of some of the older copy protection schemes which rely on simple DOS errors.

For the tougher stuff, single and dual fast "nibble" copiers are also provided. The *Super Kit* manual describes these as applicable to "light to medium duplication of DOS protected disks." It further goes on to describe these as "state-of-the-art copiers comparable to most nibble copiers available to date." While we are accustomed to products which describe themselves in superlatives, we found ourselves a bit puzzled as to what we were dealing with.

Our confusion was only furthered by the description of the Super Nibbler which is found on the second side of the disk. In this case we were presented with "THE state-of-art full disk copier for those 'impossible' duplications."

Our confusion knew no bounds when *Super Kit* informed us that there was copy protection which was so difficult it was beyond impossible. For this purpose the Disk Surgeon, or parameter copier, is supplied on side two of *Super Kit*. There was some additional confusion on the part of the manual, which frequently referred to this utility as a Sector Surgeon. The Disk Surgeon comes equipped with parameters for 271 original programs. Many of these are not in the beyond impossible category, or even in the impossible category. Instead these parameters are provided to let you clean up some of those old protection schemes. This will generally enhance loading, preserve drive alignment, and make subsequent backups even easier.

Interestingly enough, some of the beyond impossibly protected programs were not to be found on this list. However, our qualms were assuaged by James Domengeaux (pronounced very much like DiMaggio), the person behind this massive collection of program parameters. We received the distinct impression that he would not rest till all the impossible is totally mundane.

All confusion aside, all four versions of the copiers on side one of the disk worked well. The dual drive versions copied disks in well under one minute. Exact times to copy an entire disk varied, as the copiers incorporate intelligence to skip over blank sectors. The copy time for the single drive versions depended more on the manual dexterity of the operator than on the speed of the software. We found that most of the time was spent fumbling disks in and out of drives for the several pairs of swaps required to copy a full disk.

All the copiers provide user control of some of the parameters. The "normal" copiers let you set the start and end track over the range of 1 to 40. The nibblers also include settings for track increment (0.5 to 2.5), number of sync bytes, size of the header gap, length of the sector gap, and length of the header block. These are all pretty hefty parameters, well beyond the comprehension of most neophyte archivists. In any event, it's nice to

know that the tools are there if you ever do find out what you are doing.

The Super Nibbler on side two comes only in a single drive version. To prove its prowess, *Super Kit* is supplied with its own brand of protection. To get around it you must back up *Super Kit* using the Super Nibbler.

All the copiers come equipped with full pyrotechnics. The screen borders continuously flash in a pulsating display of variegated multicolor stripes through some feat of cleverly manipulating the VIC chip's interrupts. The side one copiers are accompanied by a jaunty, foot-stomping tune to keep you properly amused through the duplicative tedium. The Super Nibbler clamors for attention at every disk swap. The *Super Kit* copiers leave no doubt in the mind of the casual observer that something momentous is taking place. If nothing else, getting acquainted with *Super Kit* is not a dull experience.

Perhaps the best part of *Super Kit* is the high speed, full-fledged disk utility and file copier. As a file copier it is truly superb. The file names are automatically displayed. Just select the ones you want and sit back. A full disk with over 20 files is copied in about two minutes. The file copier also includes a 10-second disk format and a BAM display. The latter lets you allocate and deallocate sectors by marking them on the screen.

If you are looking to speed up your program loading, Super DOS may be the answer. Three versions of this utility are provided on *Super Kit.* These may be copied and placed on your own disk. The first version offers a four to one speed increase at the expense of screen blanking and shutting off the interrupts. The other two versions sacrifice some speed by leaving the screen and interrupts turned on.

A slight additional speed increase may be obtained by copying your files with the file copier's Super DOS format turned on. This optimizes the disk layout for Super DOS by adjusting the sector interleave or the spacing of sequential sectors as they are written to the disk.

Along with Super DOS you will find an Autoboot Creator utility on the first side of the disk. This lets you create an autoboot loader for the program of your choice. To speed things up, Super DOS is incorporated into the autoboot process.

Advanced users and disk hackers will be delighted by the last three utilities found on *Super Kit's* menus. The first is a full-featured track and sector editor. This simultaneously displays the contents of a disk sector in ASCII, hexadecimal, and decimal. The screen is divided horizontally into three windows with the entire 256 bytes of the selected sector displayed in ASCII at the top. The two lower windows display a part of the data in hexadecimal and decimal. The arrangement is interesting in that the text cursor moves through the data while the numerical cursors remain stationary. Instead, the numerical data scrolls under the fixed cursors.

The data may be modified in any of the three modes, that is by entering ASCII, hexadecimal, or decimal values. The sector editor includes controls which let you conveniently move about the disk by either following a chain of sectors both forwards and backwards, numerically advancing and decrementing the sector, or jumping to any sector on the disk. Disk commands are directly supported from within the editor.

The data buffer may also be manipulated with the disk editor's built-in, full-featured machine language monitor. However, the monitor's working range has been limited to a 256 byte data buffer located at $2000. Both the editor and the monitor have a built-in command to toggle the printer on and off.

The second utility is a true rarity for 1541 hackers, a full-featured GCR editor. GCR, or Group Code Recording, is Commodore's unique way of magnetically recording information on the disk. A special binary encoding format is employed which requires ten disk bits, or magnetic domains, for each byte of data. The purpose of this encoding scheme is to ensure that a valid bit stream will never have eight or more on bits or two or more off bits in a row. The former pattern is used by the Commodore DOS as the synchronization marks which mark the start of each sector. The latter pattern may cause the DOS to lose its timing with respect to the encoded data as zero bit patterns are simply regions with no magnetic transitions. The GCR editor supplied with *Super Kit* will let you acaccess the contents of the sector headers as well as the sector data blocks.

The last utility found on side two of the disk is the high speed Super Scan. This utility lets you analyze the entire disk in two ways. The first is a traditional scan for standard DOS errors from track one out to track 38. Note that tracks beyond 35 are not normally used by the DOS. The second scan is unusual in that it reports the density of the recorded data on the disk surface. The Commodore 1541 format is unique in the industry as the data is written to the disk at different rates depending on the radial position of the head. The normal recording pattern of the 1541 divides the disk surface into four density areas. Some copy protection schemes vary the density pattern.

Note that the GCR and sector editors, as well as the disk scan, are intended for advanced users. Either of the editor utilities can easily trash a disk as they work directly on the recorded data. The proper application of Super Scan and the interpretation of the results requires a working knowledge of the 1541 disk format. If you want to learn more about the arcane art of disk formatting, as applied to the 1541 disk drive, we recommend *Inside Commodore DOS* by Richard Immers and Gerald Neufeld (Datamost). This book has become the Bible in this aspect of Commodore computing.

Super Kit was not entirely free of problems. In general all of the utilities worked well with the exception of the Super Nibbler. The latter steadfastly refused to function properly on a pair of vintage 1541 disk drives (circa December 1983) or on a SX-64. We encountered no problems at all using a 1571 disk drive (circa October 1985) running in 1541 mode.

According to Mr. Domengeaux, the first copy we received was a preliminary version not fit for public consumption. To prove his point he sent a second copy of *Super Kit* which cleared up all the aforementioned problems. We also encountered a glitch in the file copier while doing all files in Super DOS mode. Some of the resulting files were not properly matched to their file names. Copying a selection of files less than the entire disk worked fine.

Super Kit obviously does some strange and terrible things with the 1541 DOS. This apparently makes it sensitive to some of the DOS versions of the past as well as the future. Alignment of your disk drive, as well as its speed and internal timing, may also prove critical. These considerations will not be unique to Super DOS. Any advanced copy utility, which works directly with the 1541's ROM routines, may be subject to these tribulations.

The creators of Super DOS were apparently of the hacker mentality, and clearly enjoyed their task. This is most obvious in the 60-page manual, of which nearly half is devoted to a "History of Commodore 64 Program Protection." We rate this manual PG (parental guidance suggested), as it has occasional lapses into colorful language which may not be suitable for small children.

Overall, *Super Kit* provides a full selection of disk utilities, ranging from simple disk maintenance to advanced hacking, which should be more than enough to satisfy the needs of most disk users. The next release of *Super Kit* will have, as of this writing, nearly 400 parameters in its data base. Prism Software is also working on a cartridge based version of their Super DOS which will speed up both LOAD and SAVE operations on the 1541.

Prism Software, 401 Lake Air Dr., Suite D, Waco, TX 76710 (phone: 817-757-4031). *—Morton Kevelson*

Back issues of *Ahoy!* are available at $4.00 each. See page 42 for ordering information.

CADET'S COLUMN

From BASIC to COMAL

By Cheryl Peterson

Last month we explored Pascal and got to know a bit about it as a programming language. We took a look at the structured nature of Pascal and found that it is much less forgiving about format and structure than BASIC is. And we found that it has more complicated data and programming structures. The CASE, WHILE, and extended FOR/NEXT and IF/THEN structures give Pascal more flexibility than C-64 BASIC.

This month we'll try a similar exercise with COMAL. But first let's find out something about COMAL.

COMAL was designed by Borge R. Christensen and Benedict Loefstedt in 1973 as a replacement for BASIC on the C-64. While it has many of the statements we're all familiar with from BASIC, other more Pascallike commands are also included. COMAL comes in two versions. COMAL 0.14 is the simpler and less expensive of the two. For $24.95 (shipping included) you get three disks with the language and many sample programs, a dictionary of commands, and four back issues of *COMAL Today,* the COMAL monthly newsletter. This starter system is a great idea for beginners, as its low price means you've lost little if you decide you don't like programming.

With thousands of programs available from the COMAL Users Group, you could actually use COMAL without ever having to do your own programming. Their disks run from $15 to $20 with shipping. Special discounts are offered to user group members and newsletter subscribers.

Those who want to write programs to distribute to friends or for commercial gain should be aware that the COMAL language is required to run COMAL programs. It is not a compiled language. You are allowed to distribute COMAL with your programs, however! No royalties to pay, either.

Version 2.0 comes on a cartridge, allows more free programming space, and has added commands. Because this kit includes a cartridge and more features, it's more expensive: $98.95 plus $4 for shipping.

AS A PROGRAMMING LANGUAGE

COMAL can be as structured as Pascal and almost as forgiving as BASIC. Both at the same time. As with BASIC, the programmer decides how structured he wants to be. Of course, good programming technique and proper structuring never hurt. And making adjustments to a program later will be much easier if the program is written using a modular style.

COMAL has all the programming structures of generic Pascal, but not as many different data structures. While COMAL understands and uses many of the same statements as BASIC, it goes farther by adding options to some of them. For instance, the IF/THEN statement can have ELSE and ELIF (else if) options. PRINT is expanded to include PRINT USING. Of course, BASIC 7.0 on the 128 has PRINT USING and ELSE.

Rather than try to cover all the differences here in the article's text, I have included tables on the following pages that show the commands available to BASIC 2.0, BASIC 7.0, and COMAL. Because Pascal is not as standardized as the BASICs and COMAL, I didn't include it in the table. Instead, a separate table shows some common Pascal keywords and their COMAL equivalents.

A quick look at the table will show the commands that COMAL has in common with the versions of BASIC you are already familiar with. You may find this helpful as you attempt to create your own programs. I have included as many of the commands as I know, and where possible have tried to note similar commands that are found under different names.

I also tried to arrange some of the commands by topics. Graphics and sprites are handled quite differently by COMAL, so I put those commands in a different area. COMAL has a graphics mode that simulates LOGO. Once activated, the graphics screen replaces the text screen and you control the movements of a turtle. This involves a whole series of commands that in no way resemble those used by the two Commodore versions of BASIC.

Another different is the handling of string functions. You may miss the statements MID$, RIGHT$, and LEFT$, but I sure won't. I never liked them. COMAL doesn't use these commands at all. Instead, when you wish to remove a substring from a large string, you specify the string name, the first character position, and last character position of the substring. For instance, let's take a string NAME$ that contains my name, CHERYL PETERSON. To use my last name, we could say LAST$:=NAME$(8:16). This assigns the characters from position 8 to position 16 of NAME$ to the string LAST$.

Though it might take a bit of getting used to, I think this manner of handling characters is actually more precise and easier to use. Of course, you must remember to DIM your strings before they are used.

Like Pascal, COMAL uses indented structuring to track modules. Unlike Pascal, COMAL tracks these structures automatically. Each new level is indented one space further than the last. And until you type the appropriate END

statement, each new line will automatically indent itself the proper amount. One point about the END statement in COMAL: Where simple ENDs are used to terminate subroutines in Pascal, COMAL has specialized ENDs for each different kind of subroutine: ENDCASE, ENDFOR, ENDFUNC, ENDIF, ENDPROC, ENDWHILE, and END (for the end of the program).

When you type the appropriate END for an indented routine, the next line is indented to its proper level without your having to do anything else. The END commands can be followed by the name of the procedure, function, or routine, making it easier to keep track of modules. Provided that you remember to put in the proper END statements where needed, COMAL formats everything with the proper indentation.

From the ENDs listed above, you can get an idea of what programming structures are available to you. In addition to BASIC's three structures (FOR, IF, and FUNC), you have Pascal's CASE, PROC, REPEAT, and WHILE. These function similarly to their Pascal counterparts in most respects.

You should know that COMAL's GOTO doesn't use line numbers. Line numbers are used while programming, but the GOTO command accesses routines by name. As with Pascal, functions and procedures are given names and can be accessed by calls to those names. There is no GOSUB command in COMAL.

COMAL includes an EXEC command to "execute" procedures, but it isn't necessary most of the time. To use a procedure or function, you merely type its name on a line. If you need to pass any parameters, these follow the routine name.

STRUCTURING

As mentioned earlier, your programs can be very structured or a bit slapdash. There are a few necessities. String variables must be defined (i.e., dimensioned) before they are used. As with Pascal, you can use local variables. In COMAL, local variables

```
0010 PRINT "SELF ADDRESSED LABELS"
0020 PRINT "COPYRIGHT 1986 AHOY! MAGAZINE"
0030 PRINT "ALL RIGHTS RESERVED"
0100 //COMAL VERSION OF SELF ADDRESSED LABELS PROGRAM//
0110 //DIM VARIABLES//
0120 DIM NAME$ OF 20, ADDRESS$ OF 40, CITY$ OF 20, ST$ OF 2, PC$ OF 9
0130 PASSES:=0; LINES:=0
0140 LABELFORMAT
0150 PRINTNUMBER
0160 READDATA
0170 PRINTOUT
0190 END
0200 PROC LABELFORMAT
0210  INPUT "HOW MANY LINES PER LABEL?": LINES
0220  IF LINES<3 THEN INPUT "AT LEAST THREE LINES PLEASE.": LINES
0230  IF LINES<3 THEN LABELFORMAT
0240  LINES:=LINES-3
0250 ENDPROC LABELFORMAT
0300 PROC PRINTNUMBER
0310  INPUT "HOW MANY LABELS TO PRINT?": PASSES
0320 ENDPROC PRINTNUMBER
0400 PROC READDATA
0410  INPUT "ENTER FULL NAME--20 CHARACTERS OR LESS.": NAME$
0420  INPUT "ENTER ADDRESS--40 CHARACTERS OR LESS.": ADDRESS$
0430  INPUT "ENTER CITY--20 CHARACTERS OR LESS.": CITY$
0440  INPUT "ENTER 2 CHARACTER STATE CODE.": ST$
0450  INPUT "ENTER ZIP CODE--9 CHARACTERS OR LESS.": PC$
0460 ENDPROC READDATA
0500 PROC PRINTOUT
0505  ZONE 3
0510  SELECT OUTPUT "LP:"
0515  FOR Y:=1 TO PASSES DO
0520   PRINT NAME$
0530   PRINT ADDRESS$
0540   PRINT CITY$;ST$;PC$
0550   FOR X:=1 TO LINES DO
0560    PRINT
0570   ENDFOR X
0580  ENDFOR Y
0590  SELECT OUTPUT "DS:"
0600 ENDPROC PRINTOUT
0700 END
```

COMAL SELF-ADDRESSED LABELS
(PASCAL STYLE)

```
0010 PRINT "SELF ADDRESSED LABELS"
0020 PRINT "COPYRIGHT 1986 AHOY! MAGAZINE"
0030 PRINT "ALL RIGHTS RESERVED"
0100 //COMAL VERSION OF SELF ADDRESSED LABELS PROGRAM//
0110 //DIM VARIABLES//
0120 DIM NAME$ OF 20, ADDRESS$ OF 40, CITY$ OF 20, ST$ OF 2, PC$ OF 9
0130 PASSES:=0; LINES:=0
0200 LABELFORMAT
0210 PROC LABELFORMAT
0220  INPUT "HOW MANY LINES PER LABEL?": LINES
0230  IF LINES<3 THEN INPUT "AT LEAST THREE LINES PLEASE.": LINES
0240  IF LINES<3 THEN LABELFORMAT
0250  LINES:=LINES-3
0260 ENDPROC LABELFORMAT
0300 //PRINTNUMBER//
0310 INPUT "HOW MANY LABELS TO PRINT?": PASSES
0400 //READDATA//
0410 INPUT "ENTER FULL NAME--20 CHARACTERS OR LESS.": NAME$
0420 INPUT "ENTER ADDRESS--40 CHARACTERS OR LESS.": ADDRESS$
0430 INPUT "ENTER CITY--20 CHARACTERS OR LESS.": CITY$
0440 INPUT "ENTER 2 CHARACTER STATE CODE.": ST$
0450 INPUT "ENTER ZIP CODE--9 CHARACTERS OR LESS.": PC$
0500 //PRINT ROUTINE//
0505 ZONE 3
0510 SELECT OUTPUT "LP:"
0515 FOR Y:=1 TO PASSES DO
0520  PRINT NAME$
0530  PRINT ADDRESS$
0540  PRINT CITY$;ST$;PC$
0550  FOR X:=1 TO LINES DO
0560   PRINT
0570  ENDFOR X
0580 ENDFOR Y
0600 SELECT OUTPUT "DS:"
0700 END
```

COMAL SELF-ADDRESSED LABELS
(BASIC STYLE)

are defined as being local by indicating that the procedure or function is CLOSED. The CLOSED statement immediately follows the routine name:

```
10 PROC write'file CLOSED
```

This statement indicates that the procedure name is write file and that the variables used within the procedure are local to that procedure. They do not affect any variables of the same name contained elsewhere in the program.

Procedures, functions, and subroutines are found at the end of a COMAL program. Structured BASIC programs generally put subroutines at the end of the program, as well. As we mentioned last month, Pascal requires functions and procedures to be named at the beginning of programs, so in this instance COMAL more closely resembles BASIC.

There is a big difference between functions in Pascal and BASIC and those in COMAL. To get the results from a function in COMAL you must use a RETURN statement. When used in this way, the RETURN assigns a value to the variable and this variable is returned to the main program for later processing. The RETURN statement can also be used to escape from a procedure and return execution back to the main program, just as it is used in BASIC.

MORE MAILING LABELS

In last month's column we developed a program to create self-addressed mailing labels. Let's do the same thing using COMAL to see how we write a COMAL program. In fact, we'll write two versions: one loosely structured, the other more formal. The first will be organized similarly to a BASIC program. The other will resemble a Pascal program.

In last month's programs we used routines called labelformat, printnumber, readdata, and print. To some extent we'll use similar names, but COMAL balks at a procedure name that is the same as a command state-

COMAL-BASIC Comparison Chart

KEY

Y: yes; N: no; M: modified

1: This keyword performs entirely different functions in each language.
2: In COMAL a whole set of commands add flexibility to this keyword. See COMAL sprite commands.
3: The extended drawing commands of COMAL add flexibility to this command. See COMAL graphics commands.
4: GET# is similar to READ FILE
5: INPUT# is similar to INPUT FILE
6: PRINT# is similar to WRITE FILE

General Commands	COMAL 0.14	BASIC 2.0	BASIC 7.0
AUTO	Y	N	Y
BASIC	Y	(1)	(1)
BEGIN/BEND	M	N	Y
CASE/OF	Y	N	N
CAT	Y	N	M(CATALOG)
CHAIN	Y	N	N
CHAR	N	N	Y
CLOSED	Y	N	N
CLR	N	Y	Y
CMD	M(SELECT)	Y	Y
CON	Y	M(CONT)	M(CONT)
DATA	Y	Y	Y
DEC	N	N	Y
DEL	Y	N	Y
DEF FN	N	Y	Y
DIM	Y	Y	Y
DIV	Y	N	N
DO	Y	N	Y
EDIT	Y	N	N
ELIF	Y	N	N
ELSE	Y	N	Y
END	Y	Y	Y
ENDCASE	Y	N	N
ENDFOR	Y	M(NEXT)	M(NEXT)
ENDFUNC	Y	N	N
ENDIF	Y	N	N
ENDPROC	Y	N	N
ENDWHILE	Y	N	N
EOD	Y	N	N
EOF	Y	N	N
ERR$	N	N	Y
ESC	Y	N	N
EXEC	Y	N	N
FALSE	Y	N	N
FOR/TO/NEXT	Y	Y	Y
FUNC	Y	M(DEF FN)	M(DEF FN)
GET	N	Y	Y
GOTO	Y	Y	Y
GOSUB	N	Y	Y
HELP	N	N	Y
HEX$	N	N	Y
IF/THEN	Y	Y	Y
IN	Y	N	M(INSTR)
INPUT	Y	Y	Y
INSTR	M(IN)	N	Y
JOY	N	N	Y
KEY	N	N	Y
KEY$	Y	M(GET)	M(GETKEY)
LET	Y	Y	Y
LINEFEED	Y	N	N
LIST	Y	Y	Y
MONITOR	N	N	Y
NEW	Y	Y	Y
NEXT	M(ENDFOR)	Y	Y
NULL	Y	N	M(SLEEP)
OF	Y	N	N
ON	N	Y	Y
OTHERWISE	Y	N	N
PASS	Y	N	N
PEN	N	N	Y
POINTER	N	N	Y
PRINT	Y	Y	Y
PRINT USING	Y	N	Y
PROC	Y	N	N
PUDEF	N	N	Y
RANDOM	Y	N	N
READ	Y	Y	Y
REF	Y	N	N
REM	Y	Y	Y
RENUM	Y	N	Y
REPEAT	Y	N	N
RESTORE	Y	Y	Y
RESUME	N	N	Y
RETURN^3	Y	N	N
RETURN^3	N	Y	Y
RUN	Y	Y	Y
SELECT OUTPUT	Y	N	N
SETEXEC	Y	N	N
SETMSG	Y	N	N
SIZE	Y	M(FRE)	M(FRE)
SPC	N	Y	Y
STATUS	Y	Y	N
STEP	Y	Y	Y
STOP	Y	Y	Y
SYS	Y	Y	Y
TAB	Y	Y	Y
THEN	Y	Y	Y
TIME	N	Y	M(TI)
TIME$	N	Y	M(TI$)
TRAP	Y	N	Y
TRON	N	N	Y
TROFF	N	N	Y
TRUE	Y	N	N
TO	Y	Y	Y
UNTIL	Y	N	Y
USR	N	Y	Y
VAL	N	Y	Y
WHEN	Y	N	N
WHILE	Y	N	Y
ZONE	Y	N	N

Disk Commands	COMAL 0.14	BASIC 2.0	BASIC 7.0
APPEND	Y	N	Y
BACKUP	N	N	Y
BLOAD	N	N	Y
BOOT	N	N	Y
BSAVE	N	N	Y
CATALOG	Y	N	M(CAT)
CLOSE	Y	Y	Y
COLLECT	N	N	Y
CONCAT	N	N	Y
COPY	N	N	Y
DCLEAR	N	N	Y
DCLOSE	M(CLOSE)	N	Y
DELETE	Y	N	M(SCRATCH)
DIRECTORY	M(CATALOG)	N	Y
DLOAD	M(CHAIN)	N	Y
DOPEN	M(OPEN)	N	Y
DSAVE	M(SAVE)	N	Y
DVERIFY	N	N	Y
ENTER	Y	M(LOAD)	M(LOAD)
GET#	N	M^4	M^4
HEADER	N	N	Y
INPUT#	M^5	Y	Y
INPUT FILE	Y	M(INPUT#)	M(INPUT#)
LOAD	Y	Y	Y
OPEN	Y	Y	Y
PRINT#	M^6	Y	Y
PRINT FILE	Y	M(PRINT#)	M(PRINT#)
READ FILE	Y	M(GET#)	M(GET#)
RECORD	N	N	Y
RENAME	N	N	Y
SAVE	Y	Y	Y
SCRATCH	M(DELETE)	N	Y
SPRSAV	N	N	Y
VERIFY	N	N	Y
WRITE FILE	Y	M(PRINT#)	M(PRINT#)

ment. So we'll use printout instead of print for that procedure.

In the BASIC-style version, we dimension our variables and then jump right in. Since the labelformat section requires testing a value and then repeating our INPUT statement if the proper value is not present, we have to use a procedure instead of a routine. The GOTO command (as mentioned earlier) does not allow jumping by line number, so we must jump to a label. In this case, we jump to a procedure name.

One difference you may notice is in the syntax of the INPUT command. If you recall, when using this statement in BASIC a semicolon usually follows the prompt you put in quotation marks and a ? appears on the screen at the end of the prompt, whether you want it there or not. One of the more popular "hints" included in programming tips columns is how to suppress the ? in INPUT commands. Without getting into that here, you should know that in COMAL it isn't necessary to do anything except place a colon after the prompt. If you want your onscreen prompt to include a question mark, you'll have to enter it before the closing quotation mark.

Notice in line 230 that our "AT LEAST THREE LINES PLEASE." is followed by a colon. When this appears on the screen it is a statement, not a question. Also, our requests for information in the readdata section appear as statements.

To open the channel to the printer in COMAL, you use the SELECT OUTPUT or SELECT command. Both work equally well. The two valid choices are "LP:" and "DS:". LP designates the line printer, DS the default screen.

Although this is the BASIC-style version, we use the FOR/TO/DO structure to print out information. Another convenience of the program is that if you forget and type the FOR/TO/NEXT routine by accident, it will automatically clean it up for you, adding the DO and changing the NEXT to an ENDFOR. Nice!

Taking a look at the Pascal-style version, we see that all our chores have been assigned to their proper proce-

Graphics and Screen Commands—BASIC 7.0	COMAL 0.14	BASIC 2.0	BASIC 7.0
BOX	N	N	Y
CIRCLE	N	N	Y
COLOR	N[2]	N	Y
DRAW	N[3]	N	Y
GRAPHIC	N[2]	N	Y
LOCATE	N	N	Y
PAINT	M(FILL)	N	Y
RWINDOW	N	N	Y
SCNCLR	N	N	Y
WIDTH	N[2]	N	Y
WINDOW	N	N	Y

Sprite Commands—BASIC 7.0	COMAL 0.14	BASIC 2.0	BASIC 7.0
BUMP	N[2]	N	Y
COLLISION	N[3]	N	Y
GSHAPE	N	N	Y
MOVSPR	N	N	Y
RCLR	N	N	Y
RGR	N	N	Y
RSPCOLOR	N	N	Y
RSPPOS	N	N	Y
RSPRITE	N	N	Y
SCALE	N	N	Y
SPRCOLOR	N[2]	N	Y
SPRDEF	N[2]	N	Y
SPRITE	N[2]	N	Y
SPRSAVE	N	N	Y
SSHAPE	N	N	Y

Sound Commands—BASIC 7.0	COMAL 0.14	BASIC 2.0	BASIC 7.0
ENVELOPE	N	N	Y
FILTER	N	N	Y
PLAY	N	N	Y
SOUND	N	N	Y
TEMPO	N	N	Y
VOL	N	N	Y

Graphic Commands—COMAL	COMAL 0.14	BASIC 2.0	BASIC 7.0
BACK	Y	N	N
BACKGROUND	Y	N	N
BORDER	Y	N	N
BOX	N	N	Y
CLEAR[1]	Y	N	N
CIRCLE	N	N	Y
DRAWTO	Y	N	M(DRAW)
FILL	Y	N	M(PAINT)
FORWARD	Y	N	N
FRAME	Y	N	N
FULLSCREEN	Y	N	N
HIDETURTLE	Y	N	N
HOME	Y	Y	Y
LEFT	Y	N	N
MOVETO	Y	N	N
PENCOLOR	Y	N	M(COLOR)
PENDOWN	Y	N	N
PENUP	Y	N	N
PLOT	Y	N	M(DRAW)
PLOTTEXT	Y	N	N
RIGHT	Y	N	N
SETGRAPHIC	Y	N	N
SETHEADING	Y	N	N
SETTEXT	Y	N	N
SETXY	Y	N	N
SHOWTURTLE	Y	N	N
SPLITSCREEN	Y	N	N
TURTLESIZE	Y	N	N

Sprite Commands—COMAL	COMAL 0.14	BASIC 2.0	BASIC 7.0
DATACOLLISION	Y	N	N
DEFINE	Y	N	M(SPRDEF)
HIDESPRITE	Y	N	N
IDENTIFY	Y	N	N
PRIORITY	Y	N	N
SPRITEBACK	Y	N	N
SPRITE-COLLISION	Y	N	N
SPRITECOLOR	Y	N	Y
SPRITEPOS	Y	N	N
SPRITESIZE	Y	N	N

Common Functions and Comparitors

ABS	ORD	AND
ATN	PEEK	OR
CHR$	POKE	NOT
COS	RND	+
EXP	SGN	–
INT	SIN	1
LEN	SQR	/
LOG	TAN	=, <, >, <=, =>

Pascal-COMAL Comparison Chart

KEYWORD	Pascal	COMAL
AND	Y	Y
ARRAY	Y	N
BEGIN	Y	M[1]
CASE	Y	Y
CONST	Y	N
DIV	Y	Y
DOWNTO	Y	N
ELSE	Y	Y
FILE	Y	N
FOR	Y	Y
FUNCTION	Y	M(FUNC)
GOTO	Y	Y
IF	Y	Y
IN	Y	Y
LABEL	Y	N
MOD	Y	Y
NIL	Y	M(NULL)
NOT	Y	Y
OF	Y	Y
OR	Y	Y
PACKED	Y	N
PROCEDURE	Y	M(PROC)
PROGRAM	Y	N
RECORD	Y	N
REPEAT	Y	Y
SET	Y	N
THEN	Y	Y
TO	Y	Y
TYPE	Y	N
UNTIL	Y	Y
VAR	Y	N
WHILE	Y	Y
WITH	Y	N

COMMANDS	Pascal	COMAL
GET	Y	M(INPUT)
INUPT	Y	M(INPUT FILE, READ FILE)
NEW	Y	Y
PACK	Y	N
PAGE	Y	N
PUT	Y	M(PRINT)
READ	Y	M(INPUT)
READLN	Y	M(INPUT)
RESET	Y	M (RESTORE)
REWRITE	Y	N
UNPACK	Y	N
WRITE	Y	M(PRINT)
WRITELN	Y	M(PRINT)

[1]This command is simulated in several other commands.

dure name. The main program thus becomes just a list of procedure names. All our routines function in the same way as their counterparts in the BASIC-style version; they are just called differently.

As you can see, COMAL falls somewhere between Pascal and BASIC. It's not quite as rigidly structured, and it retains many of BASIC's fundamental statements. For more information on COMAL, you can contact the COMAL Users Group (address below). Also, Captain C on PlayNET can also help you with any questions you may have. Send him Online Mail or reach him in the "Let's Talk COMAL" room at 9:30 p.m. EST on the first Thursday of each month.

Numerous books are available to help you learn COMAL. Most are offered by the COMAL Users Group and run in the neighborhood of $20. Most of these have sample programs, a disk of which is available for an extra fee. For those who think they may seriously use COMAL, I would suggest a subscription to the newsletter. Besides giving excellent tips on COMAL programming, subscribers get substantial discounts on disks, books, and other supplies.

Those who have the disk subscription to *Ahoy!* will be glad to hear that COMAL 0.14 and several sample programs are included on each month's disk. See page 38 in this issue for disk ordering information, or page 10 for details on getting your disk with your magazine.

Next month we'll take a look at yet another language for the C-64. ☐

COMAL Users Group USA, Ltd.
6041 Monona Drive, Room 111
Madison, WI 53716
(Phone: 608-222-4432)

SCUTTLEBUTT

Continued from page 14

gang attacks, and distillery raids are just part of the fun.

Defender of the Crown begins with the death of King Richard, as the Saxon knights prepare to clash with the plundering Normans. More than 30 animated screens are included, with graphics by Jim Sachs, who created some of the best screens ever seen on a C-64.

Sinbad and the Throne of the Falcon follows the sailor on his quest in search of the missing Caliph, as he battles black magic, man-eating monsters, and other unpleasantness.

SDI requires the young general in charge of the Strategic Defense Initiative, America's ultimate space project, to defend it from a squadron sent to destroy it by a fanatical new Soviet regime.

All four are scheduled for release in the fourth quarter of 1986, and a fifth, *Star Rush,* for first quarter 1987.

Mindscape, Inc., 800-221-9884 in US; in IL 800-942-7315; elsewhere 312-480-7667 (see address list, page 14).

10th Frame ($39.95) simulates professional bowling with a true player's perspective, 3D animation, computerized scoring, and league competition allowing up to eight bowlers to play at once. For the C-64.

Access Software, Inc., 801-298-9077 (see address list, page 14).

Four new C-64 games from Epyx:

World Games packs players off to eight different countries to compete in events specific to those locales: cliff-diving in Mexico, sumo wrestling in Japan, barrel jumping in Germany, bull riding in the US, weight lifting in the USSR, caber toss in Scotland, log rolling in Canada, and giant slalom skiing in France.

The *Super Cycle* motorcycle racing game provides a first person perspective of an obstacle-laden course which the player shares with other cyclists. A series of progressively more difficult courses are provided.

Championship Wrestling simulates the world of professional wrestling with handsome heroes and nasty villains, the use of tactics like the Atomic Drop and the Pile Driver, a boisterous, rowdy crowd, and points awarded for showmanship. Ringside ropes vibrate on impact, and grapplers are often thrown from the ring or to the mat.

Mentioned in August's *Scuttlebutt, The Movie Monster Game* stars Godzilla and five other city-stomping movie monsters. The player assumes a persona, picks a city to destroy, and begins battling the police, army, and other humans that try to stop him.

Epyx, Inc., 408-745-0700 (see address list, page 14).

MATCHBLOCKS

Continued from page 41

in the SET 1 column.

Reversed images can be obtained by adding 128 to the POKE value. The data to create the diamond shape is 233, 223, 95, 105. The program converts these numbers into the diamond shape by placing the triangle shape for POKE value 233 (reverse image of 105) to the left of the triangle shape for POKE value 223 (reverse image of 95). Below these, the triangle shape for POKE value 95 is placed to the left of the triangle shape for POKE value 105 to complete the diamond shape.

You can experiment with changing the color and shape of the block pictures by typing LIST 700-780 (after a READY prompt) and pressing the RETURN key. This will list the program lines as they appear now.

At this point there are two ways to modify a program line. One way is by retyping an entire revised line and pressing the RETURN key. The new line will be substituted for the old line. The other way is by using the two CRSR keys and the INST/DEL key. Use the CRSR keys to move up and over to the data that you want to change. Then type over just the numbers in the line that you want to change and press the RETURN key to enter the changes. Use the INST/DEL key to insert or delete extra digits. In both methods you can verify the changes by either typing LIST 700-780 to look at the program data lines or typing RUN 800 to display the entire new block set on the screen. It is possible to save different block sets by simply saving the entire program under different names.

Matchblocks was designed to be fun for the entire family. I hope you enjoy playing it and experimenting with it. ☐ ***SEE PROGRAM LISTING ON PAGE 112***

COMMODARES

PROGRAMMING CHALLENGES

By Dale Rupert

Each month, we'll present several challenges designed to stimulate your synapses and toggle the bits in your cerebral random access memory. We invite you to send your solutions to:

Commodares, c/o *Ahoy!*
P.O. Box 723
Bethel, CT 06801

We will print and discuss the cleverest, simplest, shortest, most interesting and/or most unusual solutions. Be sure to identify the *name* and *number* of the problems you are solving. Also show sample runs if possible, where appropriate. Be sure to tell what makes your solutions unique or interesting, if they are.

Programs on diskette (1541 format only) are welcome, but they must be accompanied by listings. You must enclose a stamped, self-addressed envelope if you want any of your materials returned. Solutions received by the middle of the month shown on the magazine cover are most likely to be discussed, but you may send solutions and comments any time. Your original programming problems, suggestions, and ideas are equally welcome. The best ones will become *Commodares*!

PROBLEM #33-1: VARIABLE LOG

This problem was submitted by Bill Okerblom (Providence, RI). Generate a list of all possible one- and two-character floating-point variable names. The first character must be a letter, and the second character must be a letter or a number. To make this very easy, your program may list the two-character reserved words (FN, GO, IF, etc.) as well.

PROBLEM #33-2: SENTENCE DISASSEMBLER

Steven Steckler (Columbia, MD) suggested this challenge. The user inputs a sentence or phrase. The computer responds with a list of the words in a column. Following each word is its character count. The character count column is totaled at the bottom. For example, if the user enters "COMMODARES ARE FUN," the computer output is

COMMODARES	10
ARE	3
FUN	3
	16

PROBLEM #33-3: BOUNCING BALLS

Try your graphics hand at this problem from M. N. Carswell (Eatonton, GA). Bounce a "ball" off the screen edges and off of graphics characters on the screen. For you C-128 users, use sprite 1 as the ball and have the other seven sprites trail it in a "follow the leader" fashion. Commodore 64 users may use a single graphics character.

PROBLEM #33-4: COUNTING COMBINATIONS

Jim Speers (Niles, MI) suggested this problem. Write a program which determines the number of combinations of N things taken R at a time, if the order of the N things is not important. Combinations are distinguished from permutations, in which the order of the objects chosen is important. For example, if you choose six numbers out of 44 possible numbers for the Michigan lottery, their order is not important, only their values.

As a bonus, find your chances of picking the same six numbers that the state chooses. How would your chances change if there were 45 possible numbers instead of 44? (By the way, the formula is N!(R!*(N−R!) where "!" is factorial. Any textbook on statistics will explain the concept.)

This month we will look at readers' responses to the *Commodares* from the May issue. The first problem was an interesting little challenge from Alan Flippin (San Jose, CA). *Problem #29-1: Print Maker* allows the user to enter a line number followed by any sequence of keystrokes. The keystrokes are incorporated into a string within a PRINT statement and are added to the program.

The solution from Dan Brumbaugh (Chambersburg, PA) is listed below.

```
·1 REM COMMODARES PROBLEM #29-1:
·2 REM     PRINT MAKER
·3 REM SOLUTION BY
·4 REM    DAN BRUMBAUGH
·5 REM
·10 INPUT"[CLEAR][DOWN][DOWN]ENTER LINE N
 UMBER";LN$:PRINT"[CLEAR]-[LEFT]";
·20 GET A$:IF A$="" THEN 20
·30 A=ASC(A$) : IF A=34 THEN 20
·40 IF A=13 OR LEN(S$)=71-LEN(LN$)THEN 60
·50 PRINT" [LEFT]"A$"-[LEFT]";:S$=S$+A$:G
 OTO 20
·60 Q$=CHR$(34):PRINT"[CLEAR][3"[DOWN]"]"
 LN$" PRINT"Q$"[CLEAR]"S$Q$"[HOME]"
·70 KBF=631 : NDX=198 :REM ASSUME C-64
·80 IF DS$<>"" THEN KBF=842 : NDX=208
 :REM MUST HAVE C-128 INSTEAD
·90 POKE KBF,13 : POKE NDX,1 : END
```

Dan's program creates a cursor in line 10. If the user enters a quotation mark, line 30 ignores it and goes back for more. Line 40 of Dan's program prevents the sequence of keystrokes from being too long for the C-64 to contain in one line. C-128 users may want to modify line 40.

The keystrokes are stored in S$. When the user presses the RETURN key, line 60 prints the chosen line number and a PRINT statement. Then the user's keystrokes are printed within quotation marks. Line 60 also positions the cursor so that the RETURN key code (13) which is POKEd into the keyboard buffer in line 90 will add the line to the program.

Line 70 contains the POKE values for the first address of the C-64's keyboard buffer (631) and for the index (198) which keeps track of the number of keystrokes stored in the buffer. The corresponding addresses for the C-128 are shown in line 80. The string DS$ is a C-128 disk status keyword whose length is always greater than zero on the C-128. It is normally a null string on the C-64. That is how the test in line 80 determines whether a C-64 or a C-128 is being used.

Once the keyboard buffer and index have been filled, the program ends with the cursor at the start of the new line. The computer sees the CHR$(13) in the keyboard buffer and processes it using the "dynamic keyboard" technique. The computer behaves just as if the user had pressed the RETURN key, entering the new line into the program.

There were quite a few "no frills" versions of *Problem #29-2: Generic Game.* The problem as suggested by Claude Landusky (Waianae, HI) was to let the computer select a four digit code number with no digits alike. The user tries to guess the code. The computer responds with the number of correct digits in the guess as well as the number of correct digits in the proper positions in the guess. The most compact version is the one listed below from Mark Breault (Brandon, MAN).

```
1 REM COMMODARES PROBLEM #29-2:
2 REM    GENERIC GAME
3 REM SOLUTION BY
4 REM    MARK BREAULT
5 REM
10 R%=RND(1)*10+48:FORI=1TON:ON-(Q(I)=R%)GOTO10:NEXT:N=N+1:Q(N)=R%:IFN<4GOTO10
20 INPUTA$:N=0:P=0:FORI=1TO4:FORJ=1TO4:IFQ(I)=ASC(MID$(A$,J))THENN=N+1:P=P-(I=J)
30 NEXTJ,I:K=K+1:PRINT"[UP]",N","P,K:IFP<4GOTO20
```

An interesting aspect of Mark's program is his use of the statements

```
ON -(Q(I)=R%) GOTO 10 : NEXT : ...
```

This sequence acts like an IF-THEN-ELSE expression. On the C-128 it could be rewritten as

```
IF Q(I)=R% THEN GOTO 10 ELSE NEXT : ...
```

The logical expression −(Q(I)=R%) in Mark's program has a value of 0 if the two quantities are unequal and a value of 1 if they are equal. If they are equal, the ON/GOTO statement branches to line 10. If they are unequal, the ON/GOTO statement skips to the NEXT statement. Of course any other statements could be used in place of the NEXT statement.

There were numerous other ways of selecting four differing digits for the code number. The program below is a compendium of several readers' methods:

```
1 REM COMMODARES PROBLEM #29-2:
2 REM     GENERIC GAME
3 REM  METHODS FOR CHOOSING
4 REM  FOUR UNEQUAL DIGITS
5 REM
10 REM  DAVID ALAN WRIGHT
20 N$="1234567890":FORI=1TO4:R=INT(RND(1)*(11-I))+1:D$(I)=MID$(N$,R,1):E=11-I-R
30 N$=MID$(N$,1,R-1)+MID$(N$,R+1,E):NEXT
40 FOR Q=1 TO 4 : PRINT D$(Q); : NEXT
50 REM
60 REM  MIKE STYPE
70 FORZ=0TO9:A$(Z)=RIGHT$(STR$(Z),1):NEXT
```

```
•80 R=INT(RND(1)*10):IF A$(R)="X" THEN 80
•90 B$=B$+A$(R) : A$(R)="X": IF LEN(B$)<4
 THEN 80
•100 PRINT : PRINT B$
•110 REM
•120 REM  KAREN MIDDAUGH
•130 FOR I=1 TO 4 : B=I
•140 A(I)=INT(RND(1)*10)
•150 B=B-1 : IF B=0 THEN NEXT : GOTO 180
•160 IF A(I)=A(B) THEN B=I : GOTO 140
•170 GOTO 150
•180 FOR Q=1 TO 4 : PRINT A(Q); : NEXT
•190 REM
•200 REM  DAVID HOFFNER
•210 FOR Y=0 TO 3
•220 X=INT(RND(0)*10):ON Z(X) GOTO 220:Z(
 X)=1:A$=A$+RIGHT$(STR$(X),1):NEXT
•230 PRINT : PRINT A$
```

David Alan Wright (New Britain, CT) wrote his program to avoid the use of IF statements. Mike Stype (Michigan City, IN) replaces any used digits with an "X". The program from Karen Middaugh (San Diego, CA) compares each selected digit with the previously selected ones to eliminate duplicates. David Hoffner (Brooklyn, NY) uses the Z array to keep track of selected digits. Each digit is a subscript of the array. When a digit is chosen, the corresponding element of the array is set to one.

The COMAL solution for selecting four unequal digits from Henry Farkas (Elkton, MD) is listed below.

```
•1 REM COMMODARES PROBLEM #29-2:
•2 REM      GENERIC GAME
•3 REM CHOOSING UNEQUAL DIGITS BY
•4 REM      HENRY FARKAS
•5 REM -- COMAL SOLUTION --
•100 :PROC PICK'NUMBER
•110 :PICK$:="0123456789"
•120 :PICK2$:=""
•130 :FOR X:=1 TO 4 OPEN
•140 : Y:=RND(1,LEN(PICK$))
•150 : PICK2$:=PICK2$+PICK$(Y)
•160 : CASE Y OF
•170 : WHEN 1
•180 :   PICK$:=PICK$(2:LEN(PICK$))
•190 : WHEN (LEN(PICK$))
•200 :   PICK$:=PICK$(1:(LEN(PICK$)-1))
•210 : OTHERWISE
•220 :   PICK$:=PICK$(1:(Y-1))
          + PICK$((Y+1):LEN(PICK$))
•230 : ENDCASE
•240 :ENDFOR X
•250 :ENDPROC PICK'NUMBER
```

Henry's PICK$ variable is comparable to David Wright's N$ variable in the previous program. Both examples eliminate the chosen digit from the list of choices (PICK$ or N$) before the next digit is picked.

Henry's use of the CASE statement may be new to most BASIC users. The CASE statement is similar to but more flexible than the BASIC ON/GOTO statement. When Y has the value 1, the statement under the WHEN 1 is executed. When Y has a value equal to the length of PICK$, the second WHEN statement is executed. If Y has neither of those values, the program performs the OTHERWISE statement.

The COMAL statement

```
PICK$ := PICK$(2:LEN(PICK$))
```

is equivalent to the BASIC statement

```
PICK$ = MID$(PICK$,2)
```

In other words, starting with the second character, take all characters up to the end of the string. Line 220 in Henry's program is comparable to the first statement in line 30 of David's program. Each of these lines forms a new string by taking all characters to the left of the chosen character plus all the characters of the right of the chosen character. The length of the string is thereby reduced by one.

Among the solutions for *Problem #29-3: Beat Keeper* is the following program from Bill Okerblom (Providence, RI):

```
·1 REM COMMODARES PROBLEM #29-3:
·2 REM     BEAT KEEPER
·3 REM SOLUTION BY
·4 REM   BILL OKERBLOM
·5 REM
·7 S=54272:POKES+24,15:POKES+5,0:POKES+6,
 5:POKES+1,25:D$="[8"[DOWN]"]"
·8 A$=D$+"[s M][DOWN][s M][DOWN][s M][DOW
 N][s M][DOWN][s M][DOWN][s M][DOWN][s M]
 [DOWN][s W][UP] [UP] [UP] [UP] [UP] [UP]
  [UP] "
·9 B$=D$+" [DOWN] [DOWN] [DOWN] [DOWN] [D
 OWN] [DOWN] [DOWN][s W][UP][s N][UP][s N
 ][UP][s N][UP][s N][UP][s N][UP][s N][UP
 ][s N]"
·10 G$="[HOME][DOWN] (-)SLOWER  (0)SAME
 (+)FASTER  (E)END":C$="[DOWN][DOWN] BEAT
 S PER MINUTE: "
·11 INPUT"[CLEAR][4"[DOWN]"] BEATS PER MI
 NUTE ";BM
·12 X$=A$:GOSUB13:X$=B$:GOSUB13:GOTO12
·13 TI$="[6"0"]":PRINTG$:PRINTC$;"[4" "][
 4"[LEFT]"]";BM:PRINTTAB(12)X$
·14 POKES+4,129:POKES+4,130
·15 IF TI/60 < 60/BM THEN 15
·16 GETE$:IFE$<>""THENF$=E$
·17 IFF$="+"THEN BM=BM+1:RETURN
·18 IFF$="-"THEN BM=BM-1:RETURN
·19 IFF$="E"THEN PRINT"[CLEAR]":END
·20 RETURN
```

The problem requested a simple, adjustable metronome simulation with sound, graphics, and the speed in beats per minute displayed. With Bill's program, press the "+" key once while the program is running, and the speed increases until you press the "0" key. The "–" key reduces the speed the same way. It even sounds like one of those expensive metronomes.

Thanks to Jim Speers (Niles, MI), who used a similar graphics display, to Matt Shapiro (Ft. Lee, NJ), who displayed "TIC ... TOC" in the true spirit of "simplest is best," and to Mike Stype (Michigan City, IN). Thanks also to Barry King (Nome, AK) for suggesting this *Commodare.*

Problem #29-4: Large Product brought a wide range of solutions. One from Wallace Leeker (Lemay, MO) took nine hours to run. Wallace used Allan Flippin's permutation routine from the April issue to generate all possible pairs of numbers with no duplicated digits until he found that 9642 * 87531 is the right combination to give the maximum product, namely 843,973,902.

At the other extreme is the program below from Bob Brown (Collinsville, CT). Bob's program runs in 2071 jiffies (under 35 seconds) on the C-64.

```
·1 REM COMMODARES PROBLEM #29-4:
·2 REM    LARGE PRODUCT
·3 REM SOLUTION BY
·4 REM    BOB BROWN
·5 REM
·110 FORJ=1TO4:P(J)=J:NEXT:GOSUB3000
·200 FORK=4TO1STEP-1:IFP(K)<5+KTHENGOSUB2
 000:GOTO200
·220 NEXT
·1000 PRINTB,VAL(C$),VAL(D$):STOP
·2000 P(K)=P(K)+1:IFK=4 THEN 3000
·2010 FORL=K+1TOJ:P(L)=P(L-1)+1:NEXT
·3000 A$="":B$="":C=1:FORL=1TO9
·3020 IFP(C)=LTHENA$=A$+STR$(10-L):C=C+1:
 GOTO3050
·3030 B$=B$+STR$(10-L)
·3050 NEXT
·3100 P=VAL(A$)*VAL(B$):IFP>BTHENB=P:C$=A
 $:D$=B$
·3200 RETURN
```

Bob used the fact that one number must contain four digits and the other must contain five. He sent a nice mathematical proof of that fact. Bob's program tests only 126 products. He knew that the digits in each factor must be in descending order, and his program always places the shorter of the two factors first in order to avoid testing each pair of factors twice.

Jim Speers (Niles, MI) concluded that the factors must be one four-digit and one five-digit number. He proved this by multiplying one 9 by eight 9's, two 9's by seven 9's, and so forth. The largest product was from four 9's times five 9's.

Thanks to Matt Shapiro (Ft. Lee, NJ) and Bill Hoyt (Battle Creek, MI) for their solutions and explanations to this problem.

Congratulations also to Stephan Fassbender (Saarbruecken, Federal Republic of Germany–sorry I confused your street address with your city last time), Vincent Lui, Michael Loiodice (Herkimer, NY), Necah Buyukdura (Ankara, Turkey), Don Wynkoop (Torrejon AB, Spain), Edward Oros, Jacquelin Callaway (Orange Beach, AL), John A. Haksch (Richmond, VA), Paul Sobolik (Pittsburgh, PA), Peter M. Landers, Dale Zwicker (Canada), and Lawrence Berlinski (Linden, NJ) for all your programs and explanations.

Looking forward to seeing more of your solutions and problems in next month's installment of *Commodares.* Keep those keyboards busy. □

TIPS AHOY!

Compiled by Michael R. Davila

Contributions to Tips Ahoy! *will be compensated at competitive industry rates. Send your best programming or hardware tips to* Tips Ahoy!, *c/o* Ahoy!, *Ion International Inc., 45 West 34th Street—Suite 407, New York, NY 10001. Include a stamped and self addressed envelope if you want your submission returned.*

NEW-VEC

This program allows you to change the IRQ vector. Syntax is contained in the program. For those of you who don't know how to calculate high and low bytes, the following line will do this:

```
HI=INT(A/256):LO=A-HI*256
```

where "A" is the location you want the vector to point to. This is a good program for when you want to change the vector to point to different IRQ routines in a game.

—Stephen J. O'Connor
Lake In The Hills, IL

```
·90 REMSAVE"@0:NEW-VEC",8:VERIFY"@0:NEW-V
 EC",8
·95 REM PROGRAM BY STEPHEN J. O'CONNOR
·100 FORI=828TO848:READA:CK=CK+A:POKEI,A:
 NEXT
·105 IFCK<>2299THENPRINT"[CLEAR][8"[RIGHT
 ]"][RVSON]ERROR IN DATA STATEMENTS":STOP
·110 PRINT"[CLEAR][7"[RIGHT]"][RVSON]NEW-
 VEC[RVSOFF] LOADED AND READY."
·115 PRINT"[DOWN][RIGHT]CHANGES IRQ VECTO
 R AT [RVSON]788-789[RVSOFF] TO POINT"
·120 PRINT"[DOWN][4"[RIGHT]"]AT LOCATION
 OF YOUR IRQ ROUTINE."
·125 PRINT"[DOWN][RIGHT]USE THE FOLLOWING
  SYNTAX WITH NEW-VEC:"
·130 PRINT"[DOWN][8"[RIGHT]"][RVSON]SYS 8
 28[RVSOFF],[RVSON]HI-BYTE[RVSOFF],[RVSON
 ]LO-BYTE[RVSOFF].":NEW
·135 DATA120,032,253,174,032,158
·140 DATA183,142,021,003,032,253
·145 DATA174,032,158,183,142,020
·150 DATA003,088,096
```

64 MULTI-DELETE

Here is a short routine which will take the hassle out of deleting multiple lines from a BASIC program. To use the routine simply insert the appropriate first line number minus the increment (line 60000), the increment itself (line 60001), and the last line number plus the increment (line 60002). An increment of one will delete all lines between the first and last line number.

The routine is best used by appending it to the end of a program, following the END statement. You can then execute it whenever needed with a GOTO statement. Happy deleting.

—Bob Ash
APO NY

```
·10 REM MULTIPLE DELETE EXAMPLE PROGRAM
·20 REM ***
·30 REM ***
·40 REM ***
·50 REM ***
·60 REM THESE LINES WILL BE
·70 REM DELETED WHEN THE
·80 REM PROGRAM IS RUN
·90 REM ***
·100 REM ***
·110 REM ***
·120 END
·60000 I1=10: REM (FIRST LINE - INCREMENT
 )
·60001 I1=I1+10: REM (INCREMENT)
·60002 IF I1=120 THEN END: REM (LAST LINE
  + INCREMENT)
·60003 PRINT CHR$(147):PRINT:PRINT
·60004 PRINT I1:PRINT"I1="I1":GOTO 6[3"0"
 ]1":PRINT CHR$(19)
·60005 FOR I2=631 TO 633:POKE I2,13:NEXT:
 POKE 198,3
```

DYNAMIC 128

The dynamic keyboard is a popular technique that allows modifications of a BASIC program while it is running. Since there have been numerous articles on this subject, I won't elaborate here. However, the appropriate addresses for the C-128 are not readily available. The correct procedure and addresses are provided here:

1. Onscreen, print the lines to be added to the BASIC program. Print no spaces between the BASIC lines.
2. Define any needed variables with lines like A=100. Print a GOTO <LINE NUMBER> to restart the program. Allow three spaces between each of these lines.
3. Sequentially POKE the keyboard buffer at 842 with a RETURN (the number 13) once for each line printed on the screen.
4. POKE 208 with the number of characters in the keyboard buffer.
5. Position the cursor over the first line printed on the screen and end the program.

A program is worth a thousand words, so I have written a demonstration program, *Dynamic 128.* As the program shows, the only difficulty with the dynamic keyboard is properly spacing the printed lines. The program

adds ten REM lines to itself, so it is useful only as a tutorial; however, the method can be modified to accomplish any task a programmer can imagine. —Jim Frost
La Mesa, CA

```
·10 POKE842,13:POKE843,13:POKE44,13
·20 POKE208,3
·30 IF A=<100 THHEN A=100
·40 IF A>200 THEN END
·50 PRINT"[CLEAR][DOWN][DOWN]";A;"REM ANO
THER LINE"
·60 PRINT"A=";A+10
·70 PRINT"[DOWN][DOWN]GOTO10"
·80 PRINT"[HOME]";
```

DETECTING THE HELP KEY

Use GET or GETKEY to read a function key, and they return the characters of the string assigned to that key. The function keys also have unique ASCII codes (codes 133-140), but the operating system keeps these to itself, unless you reset them. The *128 System Guide* tells you how to do this with a line of BASIC:

```
FORI=1TO8:KEYI,CHR$(I+32):NEXT
```

The HELP key also has its own unique ASCII code. But resetting HELP is a little tougher, because you can't use the KEY command. Use this one-liner instead. It sets the HELP key to CHR$(132). Slip this line into your BASIC program, and you can use GET or GETKEY to test for HELP:

```
B=0:FORA=0TO8:B=B+PEEK(4096+A):NEXT:POKE
4105,1:POKE4106+B,132
```

If you've got a screenful of instructions or a menu you'd like your user to be able to call up with a keypress, the HELP key is the natural one to use. —R. Harold Droid
Seattle, WA

COLOR-PROOF RESTORE

Pressing RUN-STOP/RESTORE may get you out of trouble, but it also resets your screen colors. To do warm resets that don't alter text, border, and background colors, DLOAD and RUN this short BASIC program.
—R. Harold Droid
Seattle, WA

```
·10 REM COLOR-PROOF RESTORE
·20 SUM=0:FORA=2816TO2885:READB:SUM=SUM+B
:POKEA,B:NEXT:IFSUM<>6299THENPRINT"ERROR
 IN DATA STATEMENTS":END
·30 SYS2816
·2816 DATA 169,14,141,0,10,169,11,141
·2824 DATA 1,10,32,37,11,96,32,37
·2832 DATA 11,173,70,11,141,33,208,173
·2840 DATA 71,11,141,32,208,173,72,11
·2848 DATA 133,241,76,3,64,120,169,50
```

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```
·2856 DATA 141,24,3,169,11,141,25,3
·2864 DATA 88,96,173,32,208,141,71,11
·2872 DATA 173,33,208,141,70,11,165,241
·2880 DATA 141,72,11,76,64,250
```

BEHEADED DISK HEADER

Disk Header, for any Commodore machine with a 1541 disk drive, is three tools in one package which allows modification of a directory's header.

To change the 16-character disk name, you would press the letter "R" and provide the new name that you want to appear in the directory. I've found that many beginning disk users format the disk using any name that comes to mind. With this option, you can give the disk a more meaningful name. To customize the ID number that's in the directory, press the "C" key. This option allows you to give a five character ID number for the directory. So, if a directory's ID contains the characters "DO 2A", it can be changed to something like "SHAWN". For the curious, the 2A is the disk format type, which is always the same for a 1541 drive!

To make a directory unlistable using the LOAD "$",8 and LIST sequence, press the "I" key. Option 1 can make the directory listable again.

A word to the wise. Whenever you use a program, such as this, that changes information on a disk, it should first be tested on a disk which contains unimportant data. That way, if the program was incorrectly entered, no valuable data will be lost. —Shawn K. Smith
Bronx, NY

```
20 REM*PROGRAM-ID.          DISK HEADER
30 REM*AUTHOR.              SHAWN K. SMITH
50 CLOSE7:CLOSE8:OPEN7,8,15,"I0"
60 S=144:OPEN8,8,8,"#"
100 POKE198,0:PRINTCHR$(147);
101 PRINTCHR$(18)TAB(15)"DISK HEADER
102 PRINT:PRINT" I-NVISIBLE DIRECTORY
104 PRINT:PRINT" R-ENAME DISK  HEADER
106 PRINT:PRINT" C-USTOM  HEADER  ID
108 PRINT:PRINT"      I, R, OR C?
109 GOSUB200
110 GETA$:IFA$><"I"ANDA$><"R"ANDA$<>"C"T
HEN110
115 IFA$="I"THENFORD=1TO3:D$=D$+CHR$(0):
NEXT:L=3
120 IFA$="C"THENINPUT"NEW  ID";D$:S=162:
L=5
125 IFA$="R"THENINPUT"NEW  HEADER";D$:L=
16
130 IFA$<>"I"THENFORD=LEN(D$)TOL:D$=D$+C
HR$(160):NEXT
160 PRINT#7,"B-P:";8;S:PRINT#8,LEFT$(D$,
L);
170 PRINT#7,"U2:";8;0;18;0:GOSUB200
180 CLOSE8:PRINT#7,"I0":CLOSE7:STOP
200 PRINT:PRINT#7,"U1:"8;0;18;0
210 PRINT#7,"B-P:";8;144:PRINTCHR$(18);
220 FORD=1TO23:GET#8,A$:A=ASC(A$+" ")
230 PRINTCHR$(A);:NEXT:PRINT:PRINT:RETUR
N
```

BASIC TRACER

Did you ever get lost in a long BASIC program with countless GOTO's, GOSUB's, or FOR-NEXT loops? This little "Navigational Tool" will put those worries to rest for good! The program, a trace routine, wedges itself into the BASIC statement execution routine. When activated, the current line number is printed in reverse video each time a BASIC program statement is executed.

Basic Tracer is turned on and off by typing a lone asterisk "*", as if it were a new BASIC command or token (actually it's token 172). Although *Basic Tracer* uses the token for multiplication as its "on-off switch," neither operation will interfere with the other.

Once the BASIC loader program is RUN, it will erase itself. Remember to save the program before running it. *Basic Tracer* is now "wedged" into the system. There is no need to remember any SYS address because there is no way to remove *Basic Tracer*, except to cold-start the computer. RUN STOP/RESTORE will not affect the program. The program will adjust itself to work on VIC 20 or C-64 and will ensure its own error checking. The BASIC loader will check for typos, and the ML will check for proper trace command syntax. —Barry L. Camp
Grand Rapids, MI

```
1 REM          BASIC TRACER
2 REM       FOR VIC-20 OR C-64
3 REM
4 REM         WRITTEN 03/04/86
5 REM         BY BARRY L. CAMP
6 REM
7 REM       USE * TO TOGGLE TRACE
8 REM            ON AND OFF
9 REM
10 AD=679:MSG=42085-8192*(PEEK(65532)=34
):Q$=CHR$(34)
11 READDT:IFDT<0THENON(AD=764)+2GOTO14,1
5
12 IFDT>255THENON(CK=DT)+2GOTO11,15
13 CK=CK+DT:POKEAD,DT:AD=AD+1:GOTO11
14 PRINT"[DOWN]THE "Q$"*"Q$" COMMAND IS"
:PRINT"NOW PART OF BASIC.":SYS700:NEW
15 POKE57,PEEK(63):POKE58,PEEK(64):PRINT
"?DATA STATEMENT";:SYSMSG
679 DATA32,115,0,208,12,174,8,3,172,187,
2,142,187,2,140,8,3,76,174,167,224,2036
700 DATA32,237,255,224,22,208,18,169,199
,141,186,2,141,251,2,169,203,4495
717 DATA141,238,2,169,221,141,233,2,162,
239,160,2,142,8,3,140,9,3,96,6606
736 DATA164,58,200,240,10,230,199,32,201
,189,198,199,32,59,171,32,115,0,8935
754 DATA201,172,240,177,32,121,0,76,231,
167,10352,-1
```

THE LAST NINJA



For the C-64

By Cleveland M. Blakemore

You stood by the burning ruins of your dojo, cradling your master's head in your arms as he breathed his last breath. Before the light faded from his eyes, he spoke one final time.

"Grasshopper. You must revenge the school, or all is lost," he said, coughing up blood. "Go and get your uniform out of the dry cleaner's."

"Master, who did this to you?" you asked.

"You ask who has done this, tadpole? The temple of Hakuro. The evil Ninja sect has been raising baby dragons to use as weapons against their enemies. You must penetrate the temple, battle the evil Ninja, and slay the dragons, or this will happen to all of Japan!" he said, waving his hand at the scorched rubble of the dojo. "When you have defeated the guardians of the temple, you will reach the upper level of consciousness, and meet your greatest enemy!" he said as he collapsed.

Right up to the end, none of his words were in sync with his lips, in the tradition of the true martial artist.

The Last Ninja is a multilevel game with smooth scrolling scenery from right to left. You are a black Ninja armed with a sword and an endless supply of shurikens (throwing stars).

You must confront a multitude of deadly opponents, from sword-wielding evil Ninjas to fire-breathing dragons. You will also have to learn how to deflect or avoid flying objects and use your acrobatic skills to leap bottomless pits which are placed at regular intervals throughout the temple. Each opponent is stronger than the last, and you may have to hit him numerous times to destroy him.

You have only one life per game, with a limited amount of "chi," or life-force. When this chi is used up, you are dead.

Being struck by projectiles takes away chi, and so does falling in pits or touching your lethal opponents. The only way to protect yourself is with your sword and your mobility.

You can raise your sword to block missiles, and you can do gymnastic flips over the bottomless pits. You can flip backwards as well as forwards, which can come in handy if you are trying to leap out of the path of projectiles.

You can also throw shurikens, but you will soon find it takes a great deal of practice to develop accuracy. A shuriken does a great deal of damage, however, if it makes contact.

The controls, with a joystick in Port 2, are as follows:

UP: Go into kneeling position. Your hand will start flicking up and down. Press the button to release the shuriken when your hands come together on the screen to throw straight ahead of you. Pressing the button at other angles throws the shuriken in different trajectories. When your upper hand is pointing in the direction you want the shuriken to fly, press the button.

DOWN: Go into ducking position. You will kneel down on all fours. If you release the joystick, you will stay at floor level, but holding it down will cause you to crouch a little lower.

RIGHT w/button down: Slash sword right. You can deflect any projectile that touches you if the sword is forward when you make contact with it. If it is back, the projectile will hit you. If you strike an opponent with the sword forward, he will be knocked back and will suffer damage.

LEFT w/button down: Slash sword left. Can sometimes be used to hit a projectile after it has passed you.

RIGHT and UP: Flip forward. You must time this move perfectly to leap over a pit in a spinning flip. If you time it right, you will land on the other side safely. If not, you will fall in and lose life-force.

LEFT and UP: Flip backwards. If you are feeling cocky and think you have the timing down sufficiently to pull it off, you can use this move to flip over low flying objects as they pass under you.

RIGHT: Move right. If you are kneeling, you will continue to creep forward on your toes. The screen scrolls left as you move along.

LEFT: Move back. The screen will not scroll when you move left.

When the game begins, you will appear at the entrance to the temple in a position of prayer. Move the joystick to get up. Whenever you stumble into a pit, you will also need a moment of prayer to summon your internal powers before you continue with your quest.

When you reach each new level in the temple, the screen border color will change. This is to alert you that the level challenger is approaching. The challenger will not begin to hurl missiles at you until he has moved ¼ into the screen. You can use this time lag to strike him with shurikens. When he begins to throw missiles, however, be prepared to duck! Each challenger has a different type of projectile, and they travel at different speeds. The challenger may hurl a shuriken, fireball, or even a baby dragon. If you do not duck, you will lose life-force when you are struck.

When your chi is completely gone, the game is over and you will return to the title screen, with your rank displayed in the red bar at the bottom.

The ranks are as follows:

1st level: Adept	6th level: Ninja
2nd level: Shugyo	7th level: Shinobi
3rd level: Yudansha	8th level: Sensei
4th level: Tiger	9th level: Shidoshi
5th level: Dragon	10th level: Jonin

The game is fairly difficult until you can master the skills of the Ninja, so don't be surprised if you spend a lot of time practicing as an Adept. You can stay in one place and practice throwing at projectiles before moving onto the next level, so try to develop some accuracy with the throwing stars!

For those of you who make it, you will find a very unusual opponent at the end of the Temple of Hakuro. To hint...

To be Ninja is to know oneself,
to face the dark side of the
inner soul and conquer....

–Daisuke Nishina
Founder of Tokakure Ryu Ninjutsu

You will need *Flankspeed,* which you will find on page 89, to enter this program. □

SEE PROGRAM LISTING ON PAGE 104

VARIABLE MANAGER

For the C-128

By R. Harold Droid

Variable Manager offers two additional commands for your 128: a FIND ("F") command and a CHANGE ("C") command.

FIND prints out the line numbers where a variable is referenced within a program. It's useful for debugging; it's also a convenient way to check a variable name for uniqueness before you use it. CHANGE lets you change variable names. If you're in the habit of using long, descriptive variable names in your programs, use the C command to turn them into short, efficient ones.

Many BASIC enhancement packages include these features, but Commodore left them out of BASIC 7.0 on the 128. Install them at the start of a programming session, and they can save you a lot of tiresome, repetitive editing.

Variable Manager occupies four blocks of memory, at addresses $1800-$1BFF (decimal 6144-6911). It wedges into BASIC by taking over the CRUNCH vector at $304-$305 (decimal 772-773; this vector points to the routine that converts BASIC keywords into tokens). The program listed on page 113 is a BASIC loader that puts *Variable Manager* into memory; it POKEs the code into place, enables the wedge, and then wipes itself out with a NEW command. So be sure to save a copy before you run the program.

To save space, the syntax for the *Variable Manager* commands is simple, and a little unforgiving. Use the "at" (@) character to designate a *Variable Manager* command. The @ character must be the first character of a line. No spaces are allowed. Follow @ with F for FIND or C for CHANGE. Other characters return a syntax error.

Follow F with a variable name. Follow C with the variable name to be replaced, a comma, and the variable name you're replacing it with. Identify string and integer variables with the symbols $ or %. Specify arrays with the character (. The CHANGE command may take a little while (maybe up to 15 seconds or so) when the variables names aren't the same length. This is because it's moving the BASIC program around to make room for longer names, or condensing to allow for shorter ones.

Variable Manager scans BASIC, finds all the variables, and compares each with the name you're finding or changing. It's smart enough to recognize that numeric, string, and array variables of the same name are distinct from one another. But it's not smart enough to know that it's been asked to replace a valid variable name with an invalid one, or a string variable with a simple array. So be careful with the CHANGE command. Be certain that the variable types agree, and that the new name is valid. Look twice before you press RETURN when using the @C command. It's probably a good idea to SAVE first, just to keep a finger slip from having unwelcome results.

By way of example, these CHANGE statements work correctly:

```
@CA,ANYTHING
@CVALUE%(,V%(
@CN$,NAME$
```

These statements, however, can lead you into real trouble:

```
@CA$(,ANY$      (different variable types)
@CNAME$,1R$     (invalid name)
@CPLACE,POSITION  (embedded keyword)
```

When switching to longer variable names, be sure you don't push your lines beyond the 160 character limit.

A lot of programs grow to an unmanageable size because there are too many variables doing too many things. *Variable Manager* helps you keep track of them. Apply descriptive names, change them as the need arises and, when you're all done, shrink them down to size. With the help of *Variable Manager* you'll always know where your variables are, and what they're doing. □

SEE PROGRAM LISTING ON PAGE 113

PROGRAM LISTINGS

Attention new *Ahoy!* readers! You must read the following information very carefully prior to typing in programs listed in *Ahoy!* Certain Commodore characters, commands, and strings of characters and commands will appear in a special format. Follow the instructions and listing guide on this page.

On the following pages you'll find several programs that you can enter on your Commodore computer. But before doing so, read this entire page carefully.

To insure clear reproductions, *Ahoy!*'s program listings are generated on a daisy wheel printer, incapable of printing the commands and graphic characters used in Commodore programs. These are therefore represented by various codes enclosed in brackets [ ]. For example: the SHIFT CLR/HOME command is represented onscreen by a heart. The code we use in our listings is [CLEAR]. The chart below lists all such codes which you'll encounter in our listings, except for one other special case.

The other special case is the COMMODORE and SHIFT characters. On the front of most keys are two symbols. The symbol on the left is obtained by pressing that key while holding down the COMMODORE key; the symbol on the right, by pressing that key while holding down the SHIFT key. COMMODORE and SHIFT characters are represented in our listings by a lower-case "s" or "c" followed by the symbol of the key you must hit. COMMODORE J, for example, is represented by [c J], and SHIFT J by [s J].

Additionally, any character that occurs more than two times in a row will be displayed by a coded listing. For example, [3 "[LEFT]"] would be 3 CuRSoR left commands in a row, [5 "[s EP]"] would be 5 SHIFTed English Pounds, and so on. Multiple blank spaces will be noted in similar fashion: e.g., 22 spaces as [22 " "].

Sometimes you'll find a program line that's too long for the computer to accept (C-64 lines are a maximum of 80 characters, or 2 screen lines long; VIC 20 lines, a maximum of 88 characters, or 4 screen lines). To enter these lines, refer to the *BASIC Command Abbreviations Appendix* in your User Manual.

On the next page you'll find our *Bug Repellent* programs for the C-128 and C-64. The version appropriate for your machine will help you proofread our programs after you type them. (Please note: the *Bug Repellent* line codes that follow each program line, in the whited-out area, should *not* be typed in. See the instructions preceding each program.)

Also on the following page you will find *Flankspeed*, our ML entry program, and instructions on its use. ☐

Call *Ahoy!* at 212-239-0855 with any problems.

When You See	It Means	You Type		You Will See
[CLEAR]	Screen Clear	SHIFT	CLR/HOME	
[HOME]	Home		CLR/HOME	
[UP]	Cursor Up	SHIFT	↑CRSR↓	
[DOWN]	Cursor Down		↑CRSR↓	
[LEFT]	Cursor Left	SHIFT	←CRSR→	
[RIGHT]	Cursor Right		←CRSR→	
[SS]	Shifted Space	SHIFT	Space	
[INSERT]	Insert	SHIFT	INST/DEL	
[DEL]	Delete		INST/DEL	
[RVSON]	Reverse On	CNTRL	9	
[RVSOFF]	Reverse Off	CNTRL	0	
[UPARROW]	Up Arrow		↑	
[BACKARROW]	Back Arrow		←	
[PI]	PI		π	
[EP]	English Pound		£	

When You See	It Means	You Type		You Will See
[BLACK]	Black	CNTRL	1	
[WHITE]	White	CNTRL	2	
[RED]	Red	CNTRL	3	
[CYAN]	Cyan	CNTRL	4	
[PURPLE]	Purple	CNTRL	5	
[GREEN]	Green	CNTRL	6	
[BLUE]	Blue	CNTRL	7	
[YELLOW]	Yellow	CNTRL	8	
[F1]	Function 1		F1	
[F2]	Function 2	SHIFT	F1	
[F3]	Function 3		F3	
[F4]	Function 4	SHIFT	F3	
[F5]	Function 5		F5	
[F6]	Function 6	SHIFT	F5	
[F7]	Function 7		F7	
[F8]	Function 8	SHIFT	F7	

BUG REPELLENT By MICHAEL KLEINERT and DAVID BARRON

Bug Repellent is a checksum program used for proofreading BASIC listings typed in from *Ahoy!* magazine. For each program line you enter, *Bug Repellent* will produce a two-letter code that should match the code listed beside that line in the magazine.

Type in, save, and run the *Bug Repellent.* (If you have a C-64, type in the C-64 version. If you have a C-128, you will need to type in the C-64 version for use with C-64 programs, and the C-128 version for use with C-128 programs.) If you have typed in *Bug Repellent* properly, you will get the message BUG REPELLENT INSTALLED; otherwise you will get an error message. If you get an error message, double check the *Bug Repellent* program for typing mistakes. Type NEW and hit RETURN. Then type in and save, or load, the *Ahoy!* program you wish to check. Type in SYS 49152 for the C-64 version or SYS 3072 for the C-128 version and hit RETURN (this will begin execution of *Bug Repellent*). You will see the prompt SCREEN OR PRINTER ? Hit S if you want the codes listed on the screen, or P if you want them listed on the printer. To pause the listing depress and hold the SHIFT key.

Compare the codes your machine generates to those listed to the right of the corresponding program lines. If you spot a difference, that line contains an error. Write down the numbers of the lines where the contradictions occur. LIST each line, locate the errors, and correct them.

COMMODORE 64 VERSION

```
·100 FOR X = 49152 TO 49488:READY:S=S+Y                AB
·110 IF Y<0 OR Y>255 THEN 130                          EA
·120 POKE X,Y:NEXT:GOTO140                             ID
·130 PRINT"[CLEAR][DOWN]**ERROR**":PRINT"[DOWN
 ]PLEASE CHECK LINE"PEEK(64)*256+PEEK(63):END          ID
·140 IF S<>44677 THEN PRINT"[CLEAR][DOWN]**ERR
 OR**":PRINT"[DOWN]PLEASE CHECK DATA LINES 170
 -500":END                                             HJ
·150 PRINT"[CLEAR]":POKE53280,0:POKE53281,6:PO
 KE646,1                                               NP
·160 PRINT"[RVSON][6" "]C-64 BUG REPELLENT INS
 TALLED[6" "]"                                         LF
·170 DATA32,161,192,165,43,133,251,165,44,133          DL
·180 DATA252,160,0,132,254,32,37,193,234,177           DB
·190 DATA251,208,3,76,138,192,230,251,208,2            OF
·200 DATA230,252,76,43,192,76,73,78,69,32              KN
·210 DATA35,32,0,169,35,160,192,32,30,171              CA
·220 DATA160,0,177,251,170,230,251,208,2,230           CE
·230 DATA252,177,251,32,205,189,169,58,32,210          JE
·240 DATA255,169,0,133,253,230,254,32,37,193           CL
·250 DATA234,165,253,160,0,76,13,193,133,253           NB
·260 DATA177,251,208,237,165,253,41,240,74,74          MB
·270 DATA74,74,24,105,65,32,210,255,165,253            EP
·280 DATA 41,15,24,105,65,32,210,255,169,13            GH
·290 DATA32,220,192,230,63,208,2,230,64,230            AN
·300 DATA251,208,2,230,252,76,11,192,169,153           NG
·310 DATA160,192,32,30,171,166,63,165,64,76            BF
·320 DATA231,192,96,76,73,78,69,83,58,32               EP
·330 DATA0,169,247,160,192,32,30,171,169,3             PJ
·340 DATA133,254,32,228,255,201,83,240,6,201           FK
·350 DATA80,208,245,230,254,32,210,255,169,4           FL
·360 DATA166,254,160,255,32,186,255,169,0,133          CL
·370 DATA63,133,64,133,2,32,189,255,32,192             GC
·380 DATA255,166,254,32,201,255,76,73,193,96           NN
·390 DATA32,210,255,173,141,2,41,1,208,249             NH
·400 DATA96,32,205,189,169,13,32,210,255,32            IM
·410 DATA204,255,169,4,76,195,255,147,83,67            KC
·420 DATA82,69,69,78,32,79,82,32,80,82                 DC
·430 DATA 73,78,84,69,82,32,63,32,0,76                 ML
·440 DATA44,193,234,177,251,201,32,240,6,138           GN
·450 DATA113,251,69,254,170,138,76,88,192,0            JK
·460 DATA0,0,0,230,251,208,2,230,252,96                NA
·470 DATA170,177,251,201,34,208,6,165,2,73             DM
·480 DATA255,133,2,165,2,208,218,177,251,201           JA
·490 DATA32,208,212,198,254,76,29,193,0,169            FM
·500 DATA13,76,210,255,0,0,0                           PA
```

COMMODORE 128 VERSION

```
·100 FAST:FOR X = 3072 TO 3520:READ Y:POKE X,Y
 :S=S+Y:TRAP110:NEXT:SLOW                              IH
·110 SLOW:IF S<>49057 THEN PRINT"[CLEAR][DOWN]
 **ERROR**":PRINT"[DOWN]PLEASE CHECK DATA LINE
 S 140-390":END                                        JA
·120 PRINT"[CLEAR][DOWN]  C-128 BUG REPELLENT
 INSTALLED"                                            II
·130 PRINT"[4" "]TYPE SYS 3072 TO ACTIVATE"            IN
·140 DATA 32,161,12,165,45,133,251,165,46,133,
 252,160,0,132,254,32,37                               OF
·150 DATA 13,234,177,251,208,3,76,138,12,230,2
 51,208,2,230,252,76,43                                NC
·160 DATA 12,76,73,78,69,32,35,32,0,169,35,160
 ,12,32,80,13,160,0,177                                OL
·170 DATA 251,170,230,251,208,2,230,252,177,25
 1,32,89,13,169,58,32,98                               EF
·180 DATA 13,169,0,133,253,230,254,32,37,13,23
 4,165,253,160,0,76,13                                 JO
·190 DATA 13,133,253,177,251,208,237,165,253,4
 1,240,74,74,74,74,24                                  LC
·200 DATA 105,65,32,98,13,165,253,41,15,24,105
 ,65,32,98,13,169,13,32                                DE
·210 DATA 220,12,230,65,208,2,230,66,230,251,2
 08,2,230,252,76,11,12                                 GM
·220 DATA 169,153,160,12,32,80,13,166,65,165,6
 6,76,231,12,96,76,73,78                               CP
·230 DATA 69,83,58,32,0,169,247,160,12,32,80,1
 3,169,3,133,254,32,107                                HC
·240 DATA 13,201,83,240,6,201,80,208,245,230,2
 54,32,98,13,169,4,166                                 GK
·250 DATA 254,160,255,32,116,13,169,0,133,65,1
 33,66,133,250,32,125,13                               LB
·260 DATA 32,134,13,166,254,32,143,13,76,73,13
 ,96,32,98,13,165,211                                  JF
·270 DATA 234,41,1,208,249,96,32,89,13,169,13,
 32,98,13,32,152,13,169,4                              GD
·280 DATA 76,161,13,147,83,67,82,69,69,78,32,7
 9,82,32,80,82,73,78,84,69                             PL
·290 DATA 82,32,63,32,0,76,44,13,234,177,251,2
 01,32,240,6,138,113,251,69                            OK
·300 DATA 254,170,138,76,88,12,0,0,0,0,230,251
 ,208,2,230,252,96,170,177                             FJ
·310 DATA 251,201,34,208,6,165,250,73,255,133,
 250,165,250,208,218,177                               GA
·320 DATA 251,201,32,208,212,198,254,76,29,13,
 0,169,13,76,98,13,0,0,32                              FI
·330 DATA 170,13,32,226,85,76,180,13,32,170,13
 ,32,50,142,76,180,13,32                               OF
·340 DATA 170,13,32,210,255,76,180,13,32,170,1
 3,32,228,255,76,180,13,32                             AK
·350 DATA 170,13,32,186,255,76,180,13,32,170,1
 3,32,189,255                                          BP
·360 DATA 76,180,13,32,170,13,32,192,255,76,18
 0,13,32,170,13                                        FP
·370 DATA 32,201,255,76,180,13,32,170,13,32,20
 4,255,76,180,13,32,170                                ID
·380 DATA 13,32,195,255,76,180,13,133,67,169,0
 ,141,0,255,165,67,96                                  BJ
·390 DATA 133,67,169,0,141,1,255,165,67,96,0,0
 ,0                                                    IF
```

FLANKSPEED FOR THE C-64 By GORDON F. WHEAT

Flankspeed will allow you to enter machine language *Ahoy!* programs without any mistakes. Once you have typed the program in, save it for future use. While entering an ML program with *Flankspeed* there is no need to enter spaces or hit the carriage return. This is all done automatically. If you make an error in a line a bell will ring and you will be asked to enter it again. To LOAD in a program Saved with *Flankspeed* use LOAD "name",1,1 for tape, or LOAD "name",8,1 for disk. The function keys may be used after the starting and ending addresses have been entered.

f1 – SAVEs what you have entered so far.

f3 – LOADs in a program worked on previously.

f5 – To continue on a line you stopped on after LOADing in the previous saved work.

f7 – Scans through the program to locate a particular line, or to find out where you stopped the last time you entered the program. f7 temporarily freezes the output as well.

```
·100 POKE53280,12:POKE53281,11                                  LL
·105 PRINT"[CLEAR][c 8][RVSON][15" "]FLANKSPEED[15" "]";        ED
·110 PRINT"[RVSON][5" "]MISTAKEPROOF ML ENTRY PROGRAM[6" "
]"                                                              MC
·115 PRINT"[RVSON][9" "]CREATED BY G. F. WHEAT[9" "]"           DM
·120 PRINT"[RVSON][3" "]COPR. 1984, ION INTERNATIONAL INC.
[3" "]"                                                         DH
·125 FORA=54272TO54296:POKEA,0:NEXT                             IM
·130 POKE54272,4:POKE54273,48:POKE54277,0:POKE54278,249:PO
KE54296,15                                                      NH
·135 FORA=680TO699:READB:POKEA,B:NEXT                           KO
·140 DATA169,251,166,253,164,254,32,216,255,96                  HJ
·145 DATA169,0,166,251,164,252,32,213,255,96                    JB
·150 B$="STARTING ADDRESS IN HEX":GOSUB430:AD=B:SR=B            KA
·155 GOSUB480:IFB=0THEN150                                      GN
·160 POKE251,T(4)+T(3)*16:POKE252,T(2)+T(1)*16                  KE
·165 B$="ENDING ADDRESS IN HEX":GOSUB430:EN=B                   LO
·170 GOSUB470:IFB=0THEN150                                      EE
·175 POKE254,T(2)+T(1)*16:B=T(4)+1+T(3)*16                      MN
·180 IFB>255THENB=B-255:POKE254,PEEK(254)+1                     GE
·185 POKE253,B:PRINT                                            HN
·190 REM  GET HEX LINE                                          IL
·195 GOSUB495:PRINT": [c P][LEFT]";:FORA=0TO8                   NH
·200 FORB=0TO1:GOTO250                                          MP
·205 NEXTB                                                      ME
·210 A%(A)=T(1)+T(0)*16:IFAD+A-1=ENTHEN340                      LE
·215 PRINT" [c P][LEFT]";                                       IK
·220 NEXTA:T=AD-(INT(AD/256)*256):PRINT" "                      PD
·225 FORA=0TO7:T=T+A%(A):IFT>255THENT=T-255                     LK
·230 NEXT                                                       IA
·235 IFA%(8)<>TTHENGOSUB375:GOTO195                             LE
·240 FORA=0TO7:POKEAD+A,A%(A):NEXT:AD=AD+8:GOTO195              BI
·245 REM    GET HEX INPUT                                       AB
·250 GETA$:IFA$=""THEN250                                       HK
·255 IFA$=CHR$(20)THEN305                                       HF
·260 IFA$=CHR$(133)THEN535                                      KH
·265 IFA$=CHR$(134)THEN560                                      JM
·270 IFA$=CHR$(135)THENPRINT" ":GOTO620                         EG
·275 IFA$=CHR$(136)THENPRINT" ":GOTO635                         AB
·280 IFA$>"@"ANDA$<"G"THENT(B)=ASC(A$)-55:GOTO295               DL
·285 IFA$>"/"ANDA$<":"THENT(B)=ASC(A$)-48:GOTO295               MD
·290 GOSUB415:GOTO250                                           JJ
·295 PRINTA$"[c P][LEFT]";                                      OA
·300 GOTO205                                                    CF
·305 IFA>0THEN320                                               PG
·310 A=-1:IFB=1THEN330                                          OI
·315 GOTO220                                                    BM
·320 IFB=0THENPRINTCHR$(20);CHR$(20);:A=A-1                     HG
·325 A=A-1                                                      BE
·330 PRINTCHR$(20);:GOTO220                                     LK
·335 REM LAST LINE                                              AD
·340 PRINT" ":T=AD-(INT(AD/256)*256)                            GJ
·345 FORB=0TOA-1:T=T+A%(B):IFT>255THENT=T-255                   PL
·350 NEXT                                                       IA
·355 IFA%(A)<>TTHENGOSUB375:GOTO195                             NF
·360 FORB=0TOA-1:POKEAD+B,A%(B):NEXT                            HN
·365 PRINT:PRINT"YOU ARE FINISHED!":GOTO535                     JA
·370 REM BELL AND ERROR MESSAGES                                FL
·375 PRINT:PRINT"LINE ENTERED INCORRECTLY":PRINT:GOTO415        DA
·380 PRINT:PRINT"INPUT A 4 DIGIT HEX VALUE!":GOTO415            FF
·385 PRINT:PRINT"ENDING IS LESS THAN STARTING!":B=0:GOTO41
5                                                               HD
·390 PRINT:PRINT"ADDRESS NOT WITHIN SPECIFIED RANGE!":B=0:
GOTO415                                                         OK
·395 PRINT:PRINT"NOT ZERO PAGE OR ROM!":B=0:GOTO415             FN
·400 PRINT"?ERROR IN SAVE":GOTO415                              PP
·405 PRINT"?ERROR IN LOAD":GOTO415                              PO
·410 PRINT:PRINT:PRINT"END OF ML AREA":PRINT                    PG
·415 POKE54276,17:POKE54276,16:RETURN                           BH
·420 OPEN15,8,15:INPUT#15,A,A$:CLOSE15:PRINTA$:RETURN           IM
·425 REM GET FOUR DIGIT HEX                                     PC
·430 PRINT:PRINTB$;:INPUTT$                                     GM
·435 IFLEN(T$)<>4THENGOSUB380:GOTO430                           NP
·440 FORA=1TO4:A$=MID$(T$,A,1):GOSUB450:IFT(A)=16THENGOSUB
380:GOTO430                                                     FJ
·445 NEXT:B=(T(1)*4096)+(T(2)*256)+(T(3)*16)+T(4):RETURN        GF
·450 IFA$>"@"ANDA$<"G"THENT(A)=ASC(A$)-55:RETURN                EH
·455 IFA$>"/"ANDA$<":"THENT(A)=ASC(A$)-48:RETURN                KP
·460 T(A)=16:RETURN                                             NP
·465 REM ADRESS CHECK                                           LI
·470 IFAD>ENTHEN385                                             LB
·475 IFB<SRORB>ENTHEN390                                        KC
·480 IFB<256OR(B>40960ANDB<49152)ORB>53247THEN395               MG
·485 RETURN                                                     IM
·490 REM ADDRESS TO HEX                                         EB
·495 AC=AD:A=4096:GOSUB520                                      FD
·500 A=256:GOSUB520                                             PE
·505 A=16:GOSUB520                                              MI
·510 A=1:GOSUB520                                               IL
·515 RETURN                                                     IM
·520 T=INT(AC/A):IFT>9THENA$=CHR$(T+55):GOTO530                 PE
·525 A$=CHR$(T+48)                                              JP
·530 PRINTA$;:AC=AC-A*T:RETURN                                  AC
·535 A$="**SAVE**":GOSUB585                                     LH
·540 OPEN1,T,1,A$:SYS680:CLOSE1                                 LH
·545 IFST=0THENEND                                              EO
·550 GOSUB400:IFT=8THENGOSUB420                                 CM
·555 GOTO535                                                    CL
·560 A$="**LOAD**":GOSUB585                                     NE
·565 OPEN1,T,0,A$:SYS690:CLOSE1                                 MF
·570 IFST=64THEN195                                             LC
·575 GOSUB405:IFT=8THENGOSUB420                                 AN
·580 GOTO560                                                    CL
·585 PRINT" ":PRINTTAB(14)A$                                    FG
·590 PRINT:A$="":INPUT"FILENAME";A$                             OM
·595 IFA$=""THEN590                                             DD
·600 PRINT:PRINT"TAPE OR DISK?":PRINT                           DF
·605 GETB$:T=1:IFB$="D"THENT=8:A$="@0:"+A$:RETURN               IG
·610 IFB$<>"T"THEN605                                           BO
·615 RETURN                                                     IM
·620 B$="CONTINUE FROM ADDRESS":GOSUB430:AD=B                   OH
·625 GOSUB475:IFB=0THEN620                                      GH
·630 PRINT:GOTO195                                              PH
·635 B$="BEGIN SCAN AT ADDRESS":GOSUB430:AD=B                   FA
·640 GOSUB475:IFB=0THEN635                                      IB
·645 PRINT:GOTO670                                              PP
·650 FORB=0TO7:AC=PEEK(AD+B):GOSUB505:IFAD+B=ENTHENAD=SR:G
OSUB410:GOTO195                                                 NK
·655 PRINT" ";:NEXTB                                            EC
·660 PRINT:AD=AD+8                                              GN
·665 GETB$:IFB$=CHR$(136)THEN195                                LI
·670 GOSUB495:PRINT": ";:GOTO650                                IB
```

GETTING UP TO SPEED

FROM PAGE 27

Assembler required for entry! See introductory article.

HRDEMO.S

```
*
* HRDEMO.S
* (HIRES DEMO PROGRAM)
*
* ENTRY POINTS:
*
* 4864 FOR FILLSCR,
* 4867 FOR DRAWSQ
*
         ORG   $1300
*
COLOR    EQU   $40
BMFLG    EQU   $D8
BMPTR    EQU   $A2D
COLMAP   EQU   $1C00
BASE     EQU   $2000
SCROLY   EQU   $D011
*
HMAX     EQU   320
HSTART   EQU   105
VSTART   EQU   66
HEND     EQU   211
VEND     EQU   132
*
SCRLEN   EQU   8000
MAPLEN   EQU   1000
*
TMPA     EQU   $FA
TPTR     EQU   TMPA
TMPB     EQU   TMPA+2
*
TBSZ     EQU   $9000
HPSN     EQU   TBSZ+2
VPSN     EQU   HPSN+2
CHAR     EQU   VPSN+1
ROW      EQU   CHAR+1
LINE     EQU   ROW+1
BYTE     EQU   LINE+1
BITT     EQU   BYTE+2
*
MPRL     EQU   BITT+1
MPRH     EQU   MPRL+1
MPDL     EQU   MPRH+1
MPDH     EQU   MPDL+1
PRODL    EQU   MPDH+1
PRODH    EQU   PRODL+1
*
FILVAL   EQU   PRODH+1
TEMPC    EQU   FILVAL+1
HPOS     EQU   TEMPC+2
*
* ENTRY POINTS:
*
         JMP   FILLSCR
         JMP   DRAWSQ
*
* BLOCK FILL ROUTINE
*
BLKFIL   LDA   FILVAL
         LDX   TBSZ+1
         BEQ   PARTPG
         LDY   #0
FULLPG   STA   (TPTR),Y
         INY
         BNE   FULLPG
         INC   TPTR+1
         DEX
         BNE   FULLPG
PARTPG   LDX   TBSZ
         BEQ   FINI
         LDY   #0
PARTLP   STA   (TPTR),Y
         INY
         DEX
         BNE   PARTLP
FINI     RTS
*
* MULT 2 16-BIT NRS
*
MULT16   LDA   #0
         STA   PRODL
         STA   PRODH
         LDX   #17
         CLC
MULT     ROR   PRODH
         ROR   PRODL
         ROR   MPRH
         ROR   MPRL
         BCC   CTDOWN
         CLC
         LDA   MPDL
         ADC   PRODL
         STA   PRODL
         LDA   MPDH
         ADC   PRODH
         STA   PRODH
CTDOWN   DEX
         BNE   MULT
         RTS
*
* PLOT ROUTINE
*
* ROW=VPSN/8
*
PLOT     LDA   VPSN
         LSR   A
         LSR   A
         LSR   A
         STA   ROW
*
* CHAR=HPSN/8
*
         LDA   HPSN
         STA   TMPA
         LDA   HPSN+1
         STA   TMPA+1
         LDX   #3
DLOOP    LSR   TMPA+1
         ROR   TMPA
         DEX
         BNE   DLOOP
         LDA   TMPA
         STA   CHAR
*
* LINE=VPSN AND 7
*
         LDA   VPSN
         AND   #7
         STA   LINE
*
* BITT=7-(HPSN AND 7)
*
         LDA   HPSN
         AND   #7
         STA   BITT
         SEC
         LDA   #7
         SBC   BITT
         STA   BITT
*
* MULTIPLY ROW * HMAX
*
         LDA   ROW
         STA   MPRL
         LDA   #0
         STA   MPRH
         LDA   #<HMAX
         STA   MPDL
         LDA   #>HMAX
         STA   MPDH
         JSR   MULT16
         LDA   MPRL
         STA   TMPA
         LDA   MPRL+1
         STA   TMPA+1
*
* ADD PRODUCT TO BASE
*
         CLC
         LDA   #<BASE
         ADC   TMPA
         STA   TMPA
         LDA   #>BASE
         ADC   TMPA+1
         STA   TMPA+1
*
* MULTIPLY 8 * CHAR
```

```
*
          LDA    CHAR
          STA    TMPB
          LDA    #0
          STA    TMPB+1
          ASL    TMPB
          ROL    TMPB+1
          ASL    TMPB
          ROL    TMPB+1
          ASL    TMPB
          ROL    TMPB+1
*
* ADD LINE
*
          CLC
          LDA    TMPB
          ADC    LINE
          STA    TMPB
          LDA    TMPB+1
          ADC    #0
          STA    TMPB+1
*
* TMPA + TMPB = BYTE
*
          CLC
          LDA    TMPA
          ADC    TMPB
          STA    TMPB
          LDA    TMPA+1
          ADC    TMPB+1
          STA    TMPB+1
*
* CALCULATE 2^BIT
*
          LDX    BITT
          INX
          LDA    #0
          SEC
SQUARE    ROL
          DEX
          BNE    SQUARE
          LDY    #0
          ORA    (TMPB),Y
          STA    (TMPB),Y
          RTS
*
* DEFINE BIT MAP,
* USE HIRES MODE
*
HIRES     STA    $FF01
          LDA    #$78
          STA    BMPTR
*
          LDA    #$20
          STA    BMFLG
*
          LDA    #0
          STA    $FF00
          LDA    SCROLY
          ORA    #$20
          STA    SCROLY
          STA    $FF01
*
* CLEAR BIT MAP
*
          LDA    #0
          STA    FILVAL
          LDA    #<BASE
          STA    TPTR
          LDA    #>BASE
          STA    TPTR+1
          LDA    #<SCRLEN
          STA    TBSZ
          LDA    #>SCRLEN
          STA    TBSZ+1
          JSR    BLKFIL
*
* SET BKG & LINE COLORS
*
          LDA    #COLOR
          STA    FILVAL
          LDA    #<COLMAP
          STA    TPTR
          LDA    #>COLMAP
          STA    TPTR+1
          LDA    #<MAPLEN
          STA    TBSZ
          LDA    #>MAPLEN
          STA    TBSZ+1
          JSR    BLKFIL
          RTS
*
* FILL SCREEN WITH COLOR
*
FILLSCR   JSR    HIRES
          LDY    #0
          STY    TEMPC
YLOOP     LDY    TEMPC
          STY    VPSN
          LDA    #0
          STA    HPSN
          STA    HPSN+1
AGIN      JSR    PLOT
          INC    HPSN
          BNE    NEXT
          INC    HPSN+1
NEXT      LDA    HPSN+1
          CMP    #>HMAX
          BCC    AGIN
          LDA    HPSN
          CMP    #<HMAX
          BCC    AGIN
          LDY    TEMPC
          INY
          STY    TEMPC
          CPY    #201
          BCC    YLOOP
*
INFIN     JMP    INFIN
*
* DRAW HORIZONTAL LINES
*
DRAWSQ    JSR    HIRES
          LDA    #VSTART
          STA    VPSN
          LDA    #<HSTART
          STA    HPSN
          LDA    #>HSTART
          STA    HPSN+1
          JSR    HDRAW
*
          LDA    #VEND
          STA    VPSN
          LDA    #<HSTART
          STA    HPSN
          LDA    #>HSTART
          STA    HPSN+1
          JSR    HDRAW
*
* DRAW VERTICAL LINES
*
          LDA    #VSTART
          STA    VPSN
          LDA    #<HSTART
          STA    HPOS
          LDA    #>HSTART
          STA    HPOS+1
          JSR    VDRAW
*
          LDA    #VSTART
          STA    VPSN
          LDA    #<HEND
          STA    HPOS
          LDA    #>HEND
          STA    HPOS+1
          JSR    VDRAW
*
INF       JMP    INF
*
HDRAW     JSR    PLOT
          INC    HPSN
          BNE    LEEP
          INC    HPSN+1
LEEP      LDA    HPSN+1
          CMP    #>HEND
          BCC    HDRAW
          LDA    HPSN
          CMP    #<HEND
          BCC    HDRAW
          RTS
*
VDRAW     LDA    HPOS
          STA    HPSN
          LDA    HPOS+1
```

IMPORTANT! Letters on white background are **Bug Repellent** line codes. **Do not enter them!** Pages 87-89 explain these codes and provide other essential information on entering ***Ahoy!*** programs. Refer to these pages **before** entering any programs!

```
342          STA   HPSN+1
343          JSR   PLOT
344          INC   HPSN
345          BNE   SKIP
346          INC   HPSN+1
347 SKIP     JSR   PLOT
348          LDX   VPSN
349          INX
350          STX   VPSN
351          CPX   #VEND
352          BCC   VDRAW
353          RTS
354 *
```

ILLUSTRIOUS GRAPHICS FROM PAGE 20

MOEBIUS PLOTTER

```
1 REM                                              JD
2 REM  RUPERT REPORT #33                           OL
3 REM   MOEBIUS PLOTTER                            NE
4 REM  = FOR THE C-128 =                           AI
5 REM                                              JD
10 GR=RGR(0) : IF GR>5 THEN GR=5                   BB
20 GRAPHIC 1,1                                     GP
30 GOSUB 500  :REM       = INITIALIZE  ==          GJ
40 GOSUB 1000 :REM       = GET POINT   ==          EO
50 GOSUB 2000 :REM       = SCALE POINT ==          NK
60 GOSUB 3000 :REM       = LIMIT POINT ==          LM
70 :  REM = PLOT POINT  =                          BK
80 XP=XS : YP=200-YS                               IE
90 REM - 1) EXIT, 2) MOVE, 3) DRAW ->              JK
100 ON MV GOSUB 120,4000,5000                      BN
110 GOTO 40      :REM - BACK FOR MORE -            IB
120 PAINT 1,RDOT(0)-2,RDOT(1)                      OC
130 GRAPHIC GR :REM RESTORE ORIG. MODE             KG
140 END                                            IC
500 :REM                 = INITIALIZE ==           FB
510 REM   - WORLD COORDINATES -                    JH
520 WL=0                                           IE
530 WR=32                                          MG
540 WT=20                                          LP
550 WB=0                                           IC
560 REM -   VIEWPORT COORDINATES      -            IO
570 REM - (0,0) IN LOWER LEFT CORNER -             HC
580 REM - (320,200) IN UPPER RIGHT    -            MF
590 VL=20                                          LM
600 VR=300                                         PF
610 VT=190                                         PK
620 VB=10                                          KP
630 IF VL>VR THEN TM=VL : VL=VR : VR=TM            KC
640 IF VT<VB THEN TM=VT : VT=VB : VB=TM            GE
650 A=(VR-VL)/(WR-WL)                              CM
660 B=VL-A*WL                                      OD
670 C=(VT-VB)/(WT-WB)                              FK
680 D=VB-C*WB                                      OD
685 :REM  DRAW VIEWPORT                            IF
690 GRAPHIC 1                                      BB
700 BOX 1,VL,200-VT,VR,200-VB                      AI
710 RETURN                                         IM
1000 :REM             = GET POINT X,Y ==           NG
1010 :REM = (X=1E29 MEANS DONE : MV=1)             KG
1020 :REM = (X<0 MEANS MOVE    : MV=2)             OO
1030 :REM = (X>=0 MEANS DRAW   : MV=3)             II
1040 MV=3          :REM ASSUME DRAW                EO
1050 READ X,Y                                      GJ
1060 IF X=1E29 THEN MV=1 : GOTO 1080               HB
1070 IF X<0 THEN X=-X : MV=2                       BL
1080 RETURN                                        IM
1090 :REM  (X,Y) PAIRS                             IP
1100 DATA -3,16,14,2,18,2,27,16                    OG
1110 DATA 25,18,5,18,3,16                          JE
1120 DATA 5,18,16,5,-14,2                          GG
1130 DATA 23,16,-27,16,6.7,16                      NN
1140 DATA 1E29,1E29                                IJ
2000 :REM         = SCALE POINT X,Y ==             GL
2010 XS=A*X+B                                      JJ
2020 YS=C*Y+D                                      JJ
2030 RETURN                                        IM
3000 :REM       = LIMIT POINT XS,YS ==             DD
3010 IF XS>VR THEN XS=VR                           EG
3020 IF XS<VL THEN XS=VL                           DM
3030 IF YS>VT THEN YS=VT                           DG
3040 IF YS<VB THEN YS=VB                           DM
3050 RETURN                                        IM
4000 DRAW 0,XP,YP     :REM  = MOVE ==              JB
4010 RETURN                                        IM
5000 DRAW 1 TO XP,YP :REM  = DRAW ==               OJ
5010 RETURN                                        IM
```

FUNCTION PLOTTER

```
1 REM                                              JD
2 REM  RUPERT REPORT #33                           OL
3 REM   FUNCTION PLOTTER                           CE
4 REM  = FOR THE C-128 =                           AI
5 REM                                              JD
10 GR=RGR(0) : IF GR>5 THEN GR=5                   BB
20 GRAPHIC 1,1                                     GP
30 GOSUB 500  :REM       =  INITIALIZE ==          GJ
40 GOSUB 5000 :REM       =  DRAW AXES  ==          EH
50 FOR X=WL TO WR STEP SS                          MD
60 GOSUB 1000  :REM      = GET POINT   ==          EO
70 GOSUB 2000  :REM      = SCALE POINT ==          NK
80 GOSUB 3000  :REM      = LIMIT POINT ==          LM
90 XP=XS : YP=200-YS                               IE
100 GOSUB 4000 :REM      = PLOT POINT  ==          KN
110 NEXT X                                         NK
120 CHAR 1,1,22,"Y MIN="+LEFT$(STR$(YN)+
SP$,15)                                            CM
130 CHAR 1,1,23,"Y MAX="+LEFT$(STR$(YX)+
SP$,15)                                            NF
140 PRINT "Y MIN="YN                               CO
```

```
·150 PRINT "Y MAX="YX                         BK
·160 GRAPHIC GR :REM RESTORE ORIG. MODE       KG
·170 END                                      IC
·180 :                                        DI
·500 :REM                  = INITIALIZE ==    FB
·510 :REM - DEFINE FUNCTION HERE -            CK
·520 :                                        DI
·530 DEF FNA(X)=SIN(X)                        DG
·540 :                                        DI
·550 SS=.1      :REM PLOT STEP SIZE           DD
·560 :REM   - GRAPH LIMITS -                  GI
·570 WL=-1      :REM MINIMUM X                GD
·580 WR=10      :REM MAXIMUM X                BI
·590 WB=-1      :REM MINIMUM Y                HI
·600 WT=1       :REM MAXIMUM Y                PA
·610 REM - VIEWPORT COORDINATES        -      IO
·620 REM - (0,0) IN LOWER LEFT CORNER -       HC
·630 REM - (320,200) IN UPPER RIGHT    -      MF
·640 VL=160                                   PD
·650 VR=310                                   PC
·660 VB=100                                   NL
·670 VT=190                                   PK
·680 IF VL>VR THEN TM=VL : VL=VR : VR=TM      KC
·690 IF VT<VB THEN TM=VT : VT=VB : VB=TM      GE
·700 A=(VR-VL)/(WR-WL)                        CM
·710 B=VL-A*WL                                OD
·720 C=(VT-VB)/(WT-WB)                        FK
·730 D=VB-C*WB                                OD
·740 YN=1E38 : YX=-1E38 :REM YMIN & YMAX      NB
·750 FOR N=1 TO 15 : SP$=SP$+" " : NEXT       AN
·760 GRAPHIC 1                                BB
·770 RETURN                                   IM
·1000 :REM                  = GET POINT ==    NM
·1010 Y=FNA(X)                                KN
·1020 PRINT CHR$(145)                         EE
·1030 CHAR 1,1,1,"X ="+LEFT$(STR$(X)+SP$,
 15)                                          HL
·1040 CHAR 1,1,2,"Y ="+LEFT$(STR$(Y)+SP$,
 15)                                          CO
·1050 IF Y<YN THEN YN=Y :REM SAVE Y MIN       PN
·1060 IF Y>YX THEN YX=Y :REM SAVE Y MAX       NF
·1070 RETURN                                  IM
·2000 :REM             = SCALE POINT X,Y ==   GL
·2010 XS=A*X+B                                JJ
·2020 YS=C*Y+D                                JJ
·2030 RETURN                                  IM
·3000 :REM               = LIMIT POINT ==     II
·3010 IF XS>VR THEN XS=VR                     EG
·3020 IF XS<VL THEN XS=VL                     DM
·3030 IF YS>VT THEN YS=VT                     DG
·3040 IF YS<VB THEN YS=VB                     DM
·3050 RETURN                                  IM
·4000 :REM          = PLOT POINT XP,YP ==     NF
·4010 DRAW 1,XP,YP                            NG
·4020 RETURN                                  IM
·5000 :REM                  = DRAW AXES ==    AP
·5010 X=0 : Y=0                               LK
·5020 GOSUB 2000   :REM SCALE (0,0)           JJ
·5030 SX=1 : SY=1                             EL
·5040 REM DOTTED LINE IF AXIS NOT VISIBLE     LF
·5050 IF XS<VL OR XS>VR THEN SY=3             ID
·5060 IF YS<VB OR YS>VT THEN SX=3             IO
·5070 GOSUB 3000 : XZ=XS : YZ=YS              AO
·5080 FOR X=VL TO VR STEP SX                  OK
·5090 DRAW 1,X,200-YZ                         LB
·5100 NEXT                                    IA
·5110 FOR Y=VB TO VT STEP SY                  LM
·5120 DRAW 1,XZ,200-Y                         NP
·5130 NEXT                                    IA
·5140 RETURN                                  IM
```

THE LARC-1 MISSION

FROM PAGE 17


```
·0 REM **********************************   DN
·1 REM *                                *   OO
·2 REM * THE LARC-I MISSION   FOR C-64  *   IF
·3 REM *                                *   OO
·4 REM *    BY JOSEPH BEDARD            *   AP
·5 REM *        1533 RIVER ST           *   OM
·6 REM *        HYDE PARK, MA  02136    *   AM
·7 REM *                                *   OO
·8 REM **********************************   DN
·9 POKE53265,0:POKE52,56:POKE56,56:CLR:PO
KE53272,30:T=RND(-TI)                        JI
·10 PRINT"[CLEAR]";:POKE53280,2:POKE53281
,5:IFPEEK(251)=1THEN20                       JG
·11 PRINT"[CLEAR][4"[DOWN]"][WHITE]PLEASE
 WAIT:":POKE1022,0:POKE1023,0                OB
·12 FORL=828TO909:READT:POKEL,T:NEXT:SYS8
28:POKE53265,27                              CF
·13 FORL=49152TO49528:READT:POKEL,T:NEXT     IH
·14 FORL=232TO239:FORL1=0TO39:POKEL*64+L1
,0:NEXT:NEXT                                 MI
·15 FORL=232TO239:FORL1=40TO63:READT:POKE
L*64+L1,T:NEXT:NEXT                          KA
·16 FORL=27TO31:FORL1=0TO7:READT:POKE1433
6+8*L+L1,T:NEXT:NEXT                         MA
·17 FORL=33TO47:FORL1=0TO7:READT:POKE1433
6+8*L+L1,T:NEXT:NEXT                         GO
·18 FORL=0TO7:POKE14840+L,PEEK(14608+L):N
EXT                                          EN
·19 FORL=828TO996:READT:POKEL,T:NEXT:POKE
251,1                                        GO
·20 POKE53265,27:GOSUB300:PRINT"[CLEAR]";
:POKE53270,216:POKE53282,1:POKE53283,2       EJ
·21 V=53248:POKEV,151:POKEV+1,150:POKE204
0,232:POKEV+2,151:POKEV+3,153                DG
·22 POKE2041,233:POKEV+37,3:POKEV+38,11:P
OKEV+39,6:POKEV+40,0:POKEV+28,5              BG
·23 POKE2042,234:POKE2043,235:POKEV+41,11
:POKEV+42,0:X=151:Y=198:S=49522              KB
·24 POKES,4:POKES+1,0:POKES+2,31:POKES+3,
0:POKES+4,24:POKES+5,2:POKES+6,2             OO
```

```
•25 FORL=1TO24:PRINTSPC(32)"[BLACK][RVSON
][8" "]";:NEXT:PRINTSPC(32)"[RVSON][7" "
][HOME][RVSOFF]";                          JO
•26 POKE2023,160:POKE56295,0:GOSUB100:Q=P
EEK(V+30):Q=PEEK(V+31)                     AN
•27 DEFFNR(T)=INT(RND(1)*T):POKE252,0:POK
E253,0:PRINT"[HOME][10"[DOWN]"]"W$:PRINT
"[UP]"S$                                   GN
•28 PRINT"[HOME][10"[DOWN]"]"SPC(15)"[5"
"]":PRINTSPC(15)"[UP][5" "]"               EA
•29 F1=1:F=-1:D=0:PRINT"[HOME]"SPC(32)"[R
VSON][BLUE]  HEAT  [DOWN][8"[LEFT]"] SEE
KER "                                      HG
•30 PRINT"[HOME][4"[DOWN]"]";:FORL=1TO4:P
RINTSPC(32)"[RVSON][YELLOW][8" "]";:NEXT LH
•31 PRINT"[HOME][10"[DOWN]"]";:FORL=1TO5:
PRINTSPC(32)"[RVSON][RED][8" "]";:NEXT     FE
•32 PRINT"[HOME][17"[DOWN]"]";:FORL=1TO4:
PRINTSPC(32)"[RVSON][PURPLE][8" "]";:NEX
T                                          PH
•33 PRINT"[HOME][5"[DOWN]"]"SPC(32)"[RVSO
N][YELLOW]DISTANCE"                        LL
•34 PRINT"[HOME][18"[DOWN]"]"SPC(33)"[RVS
ON][PURPLE]LEVEL":PRINTSPC(32)"[RVSON][U
P]"LV                                      JH
•35 PRINT"[HOME][11"[DOWN]"]"SPC(32)"[RVS
ON][RED] LONGEST[DOWN][8"[LEFT]"]DISTANC
E";                                        AM
•36 HI=PEEK(1023)*256+PEEK(1022):PRINTSPC
(32)"[RVSON][RED]"HI                       LF
•37 P=54272:GOSUB400                       GI
•38 POKEP+5,15:POKEP+6,240:POKEP+1,100:PO
KEP+4,129:POKEP+24,6                       HO
•39 POKE986,60:POKE991,3:SYS984:POKEV+21,
15                                         HF
•40 IFF1=1THENF1=0:GOTO59                  DA
•50 F=F+1:IFF>L1THENF=0:GOTO54             FC
•52 T=FNR(31):T1=FNR(5):PRINT"[HOME]"SPC(
T)O$(T1):F1=1:GOTO59                       GF
•54 PRINT"[HOME]"W$"[HOME][DOWN]"S$        EE
•55 FORL=0TO1:T=FNR(29):PRINT"[HOME]"SPC(
T)"[4" "][HOME][DOWN]"SPC(T)"[4" "]":NEX
T:F1=1                                     DB
•59 SYS49152                               KF
•60 Q=PEEK(253):IFQ=1THEN200               NG
•65 D=D+5:PRINT"[HOME][6"[DOWN]"][RVSON][
YELLOW]"SPC(32)D                           BE
•70 IFL2>10THENFORL=1TOL2:NEXT             GF
•75 GOTO40                                 PE
•100 W$="[c 7][3"["][EP]][UPARROW][BACKAR
ROW][UPARROW][UPARROW]][[EP][EP][[UPARRO
W][BACKARROW]][[EP]][UPARROW][BACKARROW]
[BACKARROW]]][UPARROW][UPARROW][BACKARRO
W][UPARROW]][["                            FF
•101 S$="[c 1][3"'"]()*+**)'(('*+)'()*++)
)**+*)'''"                                 EE
•102 O$(0)="[WHITE]$[DOWN][LEFT][BLACK]/"
:O$(1)="[c 4]#[DOWN][LEFT][c 1]."          BD
•103 O$(2)="[c 5]!?[DOWN][LEFT][LEFT][c 1
],-":RETURN                                NO
•200 POKE986,49:POKE991,234:SYS984:POKEV+
21,3:POKEV+28,0                            LB
•201 GOSUB400:POKEP+5,15:POKEP+6,240:POKE
P+1,5:POKEP+24,15:POKEP+4,129              AJ
•202 POKEV+39,7                            HD
•205 FORL=236TO239:POKE2040,L:POKE2041,L   HJ
•206 FORT=1TO150:NEXT:NEXT:POKEV+21,0      NH
•207 FORL=15TO0STEP-.1:POKEP+24,L:NEXT:PO
KEP+4,128                                  PD
•220 FORT=1TO25:SYS49152:NEXT              GB
•230 PRINT"[HOME]"SPC(10)"[BLUE][12"%"]":
SYS49152                                   EG
•231 PRINT"[HOME]"SPC(10)"[BLUE]%[RVSON][
WHITE]GAME  OVER[RVSOFF][BLUE]%":SYS4915
2                                          IH
•232 PRINT"[HOME]"SPC(10)"[BLUE][12"%"]":
SYS49152                                   EG
•233 PRINT"[HOME]"SPC(10)"[BLUE][12"&"]":
SYS49152                                   KC
•234 FORL=1TO7:SYS49152:NEXT:FORL=1TO200:
NEXT                                       IC
•251 HI=PEEK(1023)*256+PEEK(1022)          NN
•252 IFD<=HITHEN260                        AO
•253 T=INT(D/256):T1=D-T*256:POKE1023,T:P
OKE1022,T1                                 BL
•254 GOSUB400:POKEP+5,15:POKEP+6,240:FORL
=1TO15:POKEP+1,40:POKEP+4,33               KP
•255 PRINT"[HOME][13"[DOWN]"]"SPC(8)"[RVS
ON][BLUE]CONGRATULATIONS!":FORT=1TO30:NE
XT:POKEP+1,50                              MM
•256 PRINT"[HOME][13"[DOWN]"]"SPC(8)"[RVS
ON][YELLOW]CONGRATULATIONS!":FORT=1TO30:
NEXT                                       CN
•257 NEXT:GOSUB400:PRINT"[HOME][13"[DOWN]
"][RVSON][RED]"SPC(32)D                    ON
•258 PRINT"[HOME][14"[DOWN]"]"SPC(6)"[DOW
N][RED]LONGEST DISTANCE YET":FORL=1TO300
0:NEXT                                     BB
•260 GOTO20                                OK
•300 GOSUB340:PRINT"[HOME][4"[DOWN]"]"SPC
(9)"[BLUE][22"&"]"                         CB
•301 PRINTSPC(9)"[BLUE][22"%"]"            DB
•302 PRINTSPC(9)"[BLUE]%[RVSON][WHITE] TH
E LARC-I MISSION [RVSOFF][BLUE]%"          BB
•303 PRINTSPC(9)"[BLUE][22"%"]"            DB
•305 PRINT"[DOWN]"SPC(12)"BY JOSEPH BEDAR
D"                                         KL
•310 PRINT"[3"[DOWN]"]"SPC(13)"[RVSON][CY
AN] ENTER  LEVEL "                         HP
•315 PRINT"[DOWN]"SPC(14)"[RVSON][PURPLE]
1[RVSOFF][YELLOW]: EASY"                   AE
•320 PRINT"[DOWN]"SPC(14)"[RVSON][PURPLE]
2[RVSOFF][YELLOW]: MODERATE"               PE
•325 PRINT"[DOWN]"SPC(14)"[RVSON][PURPLE]
3[RVSOFF][YELLOW]: DIFFICULT"              CG
•327 POKE198,0                             KB
```

```
·330 GETA$:IFA$<"1"ORA$>"3"THEN330                    NM
·335 T=VAL(A$):LV=T:L1=(4-T)*10+1:L2=100-
 T*30:RETURN                                           LE
·340 PRINT"[CLEAR][DOWN][DOWN]";                       MC
·341 PRINTSPC(8)"[RVSON][BLACK][24" "]"                IK
·342 FORL=1TO19:PRINTSPC(8)"[RVSON][BLACK
 ] "SPC(22)" ":NEXT                                    NO
·343 PRINTSPC(8)"[RVSON][BLACK][24" "]"                IK
·345 RETURN                                            IM
·400 FORL=PTOP+23:POKEL,0:NEXT:POKEP+24,1
 5:RETURN                                              LN
·59999 REM *** ML CHARACTER TRANSFER ***               BI
·60000 DATA173,14,220,41,254,141,14                    KG
·60010 DATA220,173,24,208,41,14,10,10                  KL
·60020 DATA133,167,169,208,133,252,173                 EO
·60030 DATA0,221,41,3,73,3,10,10,10,10                 BO
·60040 DATA10,10,5,167,133,254,165,1,41                HA
·60050 DATA251,133,1,169,0,133,251,133                 NE
·60060 DATA253,168,162,8,177,251,145,253               LG
·60070 DATA200,208,249,230,252,230,254                 LJ
·60080 DATA202,208,242,165,1,9,4,133,1                 PM
·60090 DATA173,14,220,9,1,141,14,220,96                HB
·60100 REM *** ML SCROLL DATA ***                      BG
·60110 DATA174,114,193,224,3,144,3,76,117
 ,192,188,114,193,140,121,193,174                      GI
·60120 DATA118,193,232,202,32,30,193,172,
 121,193,173,119,193,201,2,208,10                      EL
·60130 DATA169,32,72,173,33,208,72,76,50,
 192,177,90,72,177,92,72,204                           CN
·60140 DATA116,193,240,20,200,177,90,72,1
 77,92,136,145,92,104,145,90,200                       CI
·60150 DATA204,116,193,208,238,240,18,136
 ,177,90,72,177,92,200,145,92,104                      AK
·60160 DATA145,90,136,204,115,193,208,238
 ,173,119,193,201,0,208,5,104,104                      KD
·60170 DATA76,111,192,104,145,92,104,145,
 90,236,117,193,208,160,96,172,116                     OJ
·60180 DATA193,200,189,114,193,170,32,30,
 193,173,120,193,201,2,208,19,136                      OP
·60190 DATA169,32,153,122,193,173,33,208,
 153,162,193,204,115,193,208,239,240                   KB
·60200 DATA16,136,177,90,153,122,193,177,
 92,153,162,193,204,115,193,208,240                    CE
·60210 DATA236,117,193,240,37,202,32,30,1
 93,172,116,193,200,136,177,90,72                      MG
·60220 DATA177,92,32,48,193,145,92,104,14
 5,90,32,56,193,204,115,193,208                        HJ
·60230 DATA234,236,117,193,208,221,240,46
 ,202,206,118,193,232,32,30,193,172                    GF
·60240 DATA116,193,200,136,32,48,193,177,
 90,72,177,92,32,56,193,145,92                         IC
·60250 DATA104,145,90,204,115,193,208,234
 ,236,118,193,208,221,238,118,193,232                  AL
·60260 DATA32,30,193,173,120,193,201,0,24
 0,20,172,115,193,136,200,185,162                      DK
·60270 DATA193,145,92,185,122,193,145,90,
 204,116,193,208,240,96,189,89,193                     EP
·60280 DATA133,91,24,105,212,133,93,189,6
 4,193,133,90,133,92,96,72,152                         IA
·60290 DATA24,105,40,168,104,96,72,152,56
 ,233,40,168,104,96,0,40,80                            LL
·60300 DATA120,160,200,240,24,64,104,144,
 184,224,8,48,88,128,168,208,248                       LK
·60310 DATA32,72,112,152,192,4,4,4,4,4,4,
 4,5,5,5,5,5                                           JG
·60320 DATA5,6,6,6,6,6,6,7,7,7,7,7,3,0,
 4,0                                                   LE
·60330 DATA4,1,1                                       HP
·60340 REM *** SPRITE DATA ***                         KK
·60390 REM SHIP                                        MJ
·60400 DATA8,0,0,38,0,0,170,128                        CF
·60410 DATA3,166,176,15,85,124,21,247                  KC
·60420 DATA213,0,85,64,0,0,0,0                         DP
·60470 REM SHIP'S SHADOW                               CD
·60480 DATA4,0,0,21,0,0,85,64                          OM
·60490 DATA1,85,80,5,85,84,21,85                       ID
·60500 DATA85,0,85,64,0,0,0,0                          LM
·60550 REM MISSLE                                      GF
·60560 DATA0,0,0,4,0,0,8,0                             DC
·60570 DATA0,8,0,0,8,0,0,8                             GO
·60580 DATA0,0,59,0,0,251,192,0                        BP
·60630 REM MISSLE'S SHADOW                             KL
·60640 DATA0,0,0,4,0,0,4,0                             EO
·60650 DATA0,4,0,0,4,0,0,4                             FC
·60660 DATA0,0,21,0,0,85,64,0                          AI
·60710 REM EXPLOSION I                                 KA
·60720 DATA0,0,0,0,0,0,0,0                             FG
·60730 DATA0,10,0,0,40,0,0,0                           JI
·60740 DATA0,0,0,0,0,0,0,0                             FG
·60790 REM EXPLOSION II                                PH
·60800 DATA0,0,0,0,0,0,34,0                            KO
·60810 DATA0,0,0,0,128,128,0,8                         EE
·60820 DATA0,0,0,0,0,0,0,0                             FG
·60870 REM EXPLOSION III                               EH
·60880 DATA0,0,0,32,0,0,0,128                          MG
·60890 DATA2,0,0,0,0,32,0,32                           KD
·60900 DATA0,0,0,128,0,0,0,0                           JC
·60950 REM EXPLOSION IV                                AC
·60960 DATA32,32,0,0,0,0,0,0                           OP
·60970 DATA0,0,8,8,0,0,0,0                             GG
·60980 DATA0,0,0,0,0,32,32,0                           ML
·61070 REM *** CHARACTER DATA ***                      BF
·61080 DATA85,85,255,255,255,255,255,255               NJ
·61090 DATA64,81,213,247,255,255,255,255               LH
·61100 DATA0,21,85,127,255,255,255,255                 NC
·61110 DATA0,0,64,85,213,255,255,255                   PK
·61120 DATA0,0,0,1,69,87,223,255                       JN
·61130 DATA5,21,22,25,5,15,51,204                      DC
·61140 DATA0,64,64,64,0,192,48,204                     FE
·61150 DATA20,85,150,187,187,187,121,20                AG
·61160 DATA24,60,60,60,60,60,60,60                     LO
·61170 DATA0,255,0,255,0,255,0,255                     NO
·61180 DATA0,0,0,0,0,0,0,255                           KF
·61190 DATA255,255,255,255,255,255,0,0                 AG
·61200 DATA255,255,255,255,243,192,0,0                 LJ
·61210 DATA255,255,255,255,63,0,0,0                    CE
```

IMPORTANT! Letters on white background are **Bug Repellent** line codes. **Do not enter them!** Pages 87-89 explain these codes and provide other essential information on entering *Ahoy!* programs. Refer to these pages **before** entering any programs!

```
•61220 DATA255,255,255,240,192,0,0,0          FH
•61230 DATA255,207,3,0,0,0,0,0                NG
•61240 DATA255,15,3,15,15,3,0,0               OH
•61250 DATA252,192,0,192,192,0,0,0            CH
•61260 DATA195,255,255,255,255,60,0,0         MP
•61270 DATA60,60,60,60,60,24,0,0              MP
•61280 REM *** ML ROUTINE ***                 GB
•61290 DATA174,0,220,224,123,208,11,172,0
,208,136,192,24,240,3,76,90,3,224,119         FB
•61300 DATA208,17,172,0,208,200,192,255,2
40,9,140,0,208,140,2,208,76,135,3,224         KA
•61310 DATA126,208,11,172,1,208,136,192,1
00,240,3,76,126,3,224,125,208,17,172,1        HP
•61320 DATA208,200,192,198,240,9,140,1,20
8,152,105,3,141,3,208,166,252,224,1,240       DD
•61330 DATA12,162,1,134,252,169,252,172,0
,208,76,161,3,173,5,208,172,0,208,233         AH
•61340 DATA1,141,5,208,105,3,141,7,208,14
0,4,208,140,6,208,173,1,208,205,5             KG
•61350 DATA208,208,4,162,1,134,253,172,31
,208,152,41,1,201,1,208,4,162,1,134           FN
•61360 DATA253,152,41,4,201,4,208,4,162,0
,134,252,76,49,234,0                          AJ
•61370 DATA120,169,60,141,20,3,169,3,141,
21,3,88,96                                    JH
```

DUAL-DUMP 128
FROM PAGE 43

```
•1 REM DUAL-DUMP 128                          LJ
•10 SUM=0:BANK15:FORI=6656TO7049:READJ:PO
KEI,J:SUM=SUM+J:NEXT:IFSUM<>42253THENPRI
NT"ERROR IN DATA STATEMENTS":END              NE
•20 SYS6656                                   HN
•6656 DATA 76,6,26,76,52,26,169,25            HG
•6664 DATA 141,0,10,169,26,141,1,10           AI
•6672 DATA 32,11,27,169,0,141,139,27          FB
•6680 DATA 96,32,11,27,76,3,64,173            AC
•6688 DATA 139,27,208,5,32,24,27,176          MI
•6696 DATA 3,76,64,250,169,1,141,138          GN
•6704 DATA 27,76,57,26,169,0,141,138          NF
•6712 DATA 27,169,1,141,139,27,165,215        AI
•6720 DATA 240,3,76,160,26,173,44,10          IE
•6728 DATA 41,2,240,4,160,7,208,2             HL
•6736 DATA 160,0,140,143,27,32,66,27          IG
•6744 DATA 32,95,27,169,0,141,107,26          OL
•6752 DATA 169,4,141,108,26,169,40,141        HB
•6760 DATA 140,27,173,255,255,32,118,27       GG
•6768 DATA 32,210,255,206,140,27,208,13       PJ
•6776 DATA 169,40,141,140,27,169,13,32        HL
•6784 DATA 210,255,32,95,27,173,107,26        JM
•6792 DATA 201,231,208,7,173,108,26,201       II
•6800 DATA 7,240,10,238,107,26,208,210        KA
•6808 DATA 238,108,26,208,205,76,243,26       LO
•6816 DATA 165,241,41,128,240,4,160,7         LB
•6824 DATA 208,2,160,0,140,143,27,32          JD
•6832 DATA 66,27,169,0,141,141,27,141         GC
•6840 DATA 142,27,160,18,169,0,32,106         HO
•6848 DATA 27,160,19,169,0,32,106,27          EM
•6856 DATA 169,31,141,0,214,44,0,214          CP
•6864 DATA 16,251,173,1,214,32,118,27         MC
•6872 DATA 32,210,255,173,141,27,201,207      NF
•6880 DATA 208,7,173,142,27,201,7,240         EM
•6888 DATA 10,238,141,27,208,218,238,142      IJ
•6896 DATA 27,208,213,169,13,32,210,255       OE
•6904 DATA 169,4,32,74,255,169,0,141          GH
•6912 DATA 139,27,173,138,27,208,1,96         MK
•6920 DATA 76,41,26,120,169,31,141,24         ND
•6928 DATA 3,169,26,141,25,3,88,96            OO
•6936 DATA 173,1,220,205,1,220,208,248        DG
•6944 DATA 169,191,141,0,220,173,1,220        OD
•6952 DATA 201,239,240,15,169,253,141,0       DE
•6960 DATA 220,173,1,220,201,127,240,3        OO
•6968 DATA 24,144,1,56,169,127,141,0          LG
•6976 DATA 220,96,169,0,32,189,255,169        LI
•6984 DATA 4,162,4,172,143,27,32,186          LH
•6992 DATA 255,32,192,255,162,4,32,201        PI
•7000 DATA 255,169,13,32,210,255,96,162       EL
•7008 DATA 19,169,32,32,210,255,202,16        JI
•7016 DATA 248,96,140,0,214,44,0,214          PB
•7024 DATA 16,251,141,1,214,96,41,127         AL
•7032 DATA 201,32,144,9,201,64,144,9          CK
•7040 DATA 201,96,144,3,24,105,32,105         PL
•7048 DATA 32,96                              JF
```

DOGCATCHER
FROM PAGE 60

Beginning address in hex: C000
Ending address in hex: CEC7
SYS to Start: 49152
***Flankspeed* required for entry! See page 89.**

```
C000: 20 3E C6 20 46 CD 20 06 7F
C008: C2 A9 B9 8D CD 06 4C 70 4C
C010: CB 00 EE A7 02 AD A7 02 CB
C018: C9 05 D0 23 A9 00 8D A7 B9
C020: 02 AD FB 07 C9 C7 F0 0D 62
C028: A9 C7 8D FB 07 A9 C9 8D 2B
C030: FC 07 4C 3F C0 A9 C8 8D 80
C038: FB 07 A9 CA 8D FC 07 A5 E6
C040: FB C9 07 F0 03 4C 5E C0 6C
C048: A9 01 85 FB A9 3D 8D 07 EF
C050: D0 8D 09 D0 A9 0D 8D 06 D2
C058: D0 A9 FF 8D 08 D0 A5 FB DA
C060: C9 00 F0 2B C9 01 F0 18 1A
C068: C9 02 F0 46 C9 03 F0 10 39
C070: C9 04 F0 0C C9 05 F0 3A 35
C078: C9 06 F0 54 4C F8 C0 EA 7E
```

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C080: EE 06 D0 CE 08 D0 AD 08 A3
C088: D0 C9 86 D0 05 E6 FB 4C AE
C090: F8 C0 AD 08 D0 C9 FF D0 6B
C098: 14 E6 FB A9 7D 8D 07 D0 1C
C0A0: 8D 09 D0 A9 FF 8D 08 D0 18
C0A8: A9 0D 8D 06 D0 4C F8 C0 C9
C0B0: EA EA EE 07 D0 EE 09 D0 16
C0B8: AD 09 D0 C9 5D D0 05 E6 24
C0C0: FB 4C F8 C0 AD 09 D0 C9 14
C0C8: 9D D0 02 E6 FB 4C F8 C0 22
C0D0: EE 06 D0 CE 08 D0 AD 06 F1
C0D8: D0 C9 FF D0 14 E6 FB A9 E4
C0E0: 3D 8D 07 D0 8D 09 D0 A9 94
C0E8: 0D 8D 06 D0 A9 FF 8D 08 99
C0F0: D0 4C F8 C0 EA EA EA EA 73
C0F8: EE A8 02 AD A8 02 C9 05 B9
C100: D0 23 A9 00 8D A8 02 AD 83
C108: FD 07 C9 C7 F0 0D A9 C7 0E
C110: 8D FD 07 A9 C9 8D FE 07 A9
C118: 4C 25 C1 A9 C8 8D FD 07 50
C120: A9 CA 8D FE 07 A5 FC C9 94
C128: 07 F0 03 4C 44 C1 A9 01 20
C130: 85 FC A9 5D 8D 0B D0 8D B0
C138: 0D D0 A9 0D 8D 0A D0 A9 DE
C140: FF 8D 0C D0 A5 FC C9 00 17
C148: F0 18 C9 01 F0 18 C9 02 F0
C150: F0 50 C9 03 F0 10 C9 04 2D
C158: F0 48 C9 05 F0 08 C9 06 29
C160: F0 5E 4C E1 C1 EA EE 0A 83
C168: D0 CE 0C D0 AD 0C D0 C9 39
C170: D2 D0 05 E6 FC 4C E1 C1 EC
C178: AD 0C D0 C9 86 D0 05 E6 10
C180: FC 4C E1 C1 AD 0C D0 C9 C1
C188: 0D D0 F6 E6 FC A9 BD 8D 36
C190: 0B D0 8D 0D D0 A9 0D 8D 1C
C198: 0A D0 A9 FF 8D 0C D0 4C D3
C1A0: E1 C1 EE 0B D0 EE 0D D0 DB
C1A8: AD 0D D0 C9 7D D0 05 E6 38
C1B0: FC 4C E1 C1 AD 0D D0 C9 F2
C1B8: 9D D0 02 E6 FC 4C E1 C1 FC
C1C0: EE 0A D0 CE 0C D0 AD 0C EF
C1C8: D0 C9 0D D0 14 E6 FC A9 E2
C1D0: 5D 8D 0B D0 8D 0D D0 A9 AC
C1D8: 0D 8D 0A D0 A9 FF 8D 0C 91
C1E0: D0 A5 4B 8D AA 02 A9 14 9A
C1E8: 8D A9 02 CE A9 02 AD A9 F3
C1F0: 02 C9 00 D0 F6 CE AA 02 FF
C1F8: AD AA 02 D0 E9 60 00 00 6E
C200: 00 00 00 00 00 00 78 A9 22
C208: F8 8D 14 03 A9 CD 8D 15 BF
C210: 03 58 60 AA AA AA A1 04 71
C218: 12 A1 04 12 AD D7 DE B5 FB
C220: 55 57 AD F7 D6 AD C7 1E DC
C228: AD C7 12 B5 55 57 A1 04 B7
C230: 12 A1 34 12 AD D4 DE B5 41
C238: 55 57 AD F7 DE AD C4 D6 B2
C240: AD C4 DE AD C4 12 AA AA 6B
C248: AA 00 FC 00 00 DC 00 00 CC
C250: FC 00 00 00 00 00 00 00 4D
C258: 00 00 03 00 00 0F C0 C0 EB
C260: 0C C0 B0 05 00 2C 01 00 10
C268: 8B 01 00 20 CA 00 80 3A 9A
C270: 80 00 0E 20 00 0B 08 00 32
C278: 03 E0 00 00 B0 00 05 00 12
C280: 00 11 00 00 11 00 00 10 B2
C288: 40 00 30 30 00 30 30 00 89
C290: F0 F0 00 00 00 00 00 00 72
C298: 00 00 0C 00 00 3F 00 C0 A4
C2A0: 33 00 B0 14 00 2C 04 00 C8
C2A8: 8B 04 00 20 CA 00 80 3A DD
C2B0: 80 00 0E 20 00 0B 08 00 72
C2B8: 03 E0 00 00 B0 00 05 00 52
C2C0: 00 05 00 00 05 00 00 05 CF
C2C8: 00 00 0C C0 00 0C C0 00 62
C2D0: 33 00 00 00 00 00 00 00 04
C2D8: 00 00 03 00 00 0F C0 00 AB
C2E0: 0C C0 00 05 00 00 01 00 B3
C2E8: 00 01 00 00 0A AA 00 2A C8
C2F0: 0C 00 8A 38 00 8A C0 00 0B
C2F8: 07 00 00 2D 00 00 35 00 62
C300: 00 D1 00 03 11 00 0C 10 02
C308: 40 38 30 30 E0 30 30 A8 CA
C310: F0 C0 00 00 00 00 00 00 C1
C318: 00 00 C0 00 03 F0 00 03 CF
C320: 30 03 01 40 0E 01 00 38 DB
C328: 01 00 E2 02 83 08 02 AC 48
C330: 02 08 B0 00 22 E0 00 0B F8
C338: C0 00 0E 00 00 01 40 00 48
C340: 01 10 00 01 10 00 04 04 6A
C348: 00 0C 0C 00 0C 0C 00 0F 87
C350: 0F 00 00 00 00 00 00 00 5F
C358: 00 00 30 00 00 FC 00 00 85
C360: CC 03 00 50 0E 00 40 38 07
C368: 00 40 E2 00 83 08 02 AC C5
C370: 02 08 B0 00 22 E0 00 0B 39
C378: C0 00 0E 00 00 01 40 00 88
C380: 01 40 00 01 40 00 01 10 14
C388: 00 03 30 00 03 30 00 00 EE
C390: CC 00 00 00 00 00 00 00 5D
C398: 00 00 C0 00 03 F0 00 03 50
C3A0: 30 00 01 40 00 01 00 00 13
C3A8: 01 00 00 AA 80 00 62 A0 D7
C3B0: 00 32 20 00 0F 20 00 03 35
C3B8: C0 00 02 30 00 01 4C 00 F8
C3C0: 01 13 00 01 10 C0 04 04 AE
C3C8: 30 0C 0C 2C 0C 0C 0B 03 63
C3D0: 0F 22 00 00 00 00 00 00 02
C3D8: 00 00 00 00 00 00 00 00 D8
C3E0: 00 00 00 00 00 00 00 00 E0
C3E8: 00 00 00 00 00 00 00 00 E8
C3F0: 00 00 00 00 00 00 00 00 F0
C3F8: 00 00 00 08 00 00 0B 00 0C
C400: 00 0A 80 02 AA 40 0A AA 2C
C408: 80 22 08 00 02 08 00 02 BE
C410: 20 00 00 00 00 00 00 00 30
C418: 00 00 00 00 00 00 00 00 18
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C420: 00 00 00 00 00 00 00 00 20
C428: 00 00 00 00 00 00 00 00 28
C430: 00 00 00 00 00 00 00 00 30
C438: 00 00 00 08 00 00 0B 00 4B
C440: 00 0A 80 0A AA 40 22 AA 8C
C448: 80 02 08 00 02 08 00 08 E4
C450: 08 00 00 00 00 00 00 00 58
C458: 00 00 00 00 00 00 00 00 58
C460: 00 00 00 00 00 00 00 00 60
C468: 00 00 00 00 00 00 00 00 68
C470: 00 00 00 00 00 00 00 00 70
C478: 00 00 00 20 00 00 E0 00 79
C480: 02 A0 00 01 AA 80 02 AA FB
C488: A0 00 20 88 00 20 80 00 72
C490: 08 80 00 00 00 00 00 00 19
C498: 00 00 00 00 00 00 00 00 98
C4A0: 00 00 00 00 00 00 00 00 A0
C4A8: 00 00 00 00 00 00 00 00 A8
C4B0: 00 00 00 00 00 00 00 00 B0
C4B8: 00 00 00 20 00 00 E0 00 B9
C4C0: 02 A0 00 01 AA A0 02 AA 5C
C4C8: 88 00 20 80 00 20 80 00 92
C4D0: 20 20 00 00 00 00 00 00 11
C4D8: 00 00 C0 00 03 F0 00 03 90
C4E0: 30 02 01 40 0B 01 00 3E 9E
C4E8: 01 00 EF 02 83 38 02 AC 46
C4F0: 3F 08 B0 3C 22 E0 3C 0B 6F
C4F8: C0 3C 0E 00 3F 01 40 C0 45
C500: 01 13 00 01 10 00 04 04 2D
C508: 00 0C 0C 00 0C 0C 00 0F 47
C510: 0F 00 00 AA AA AA A1 04 C4
C518: 12 A1 04 12 A1 04 12 B5 4F
C520: 55 57 A1 04 12 A1 04 12 3C
C528: A1 04 12 B5 55 57 A1 04 E7
C530: 12 A1 04 12 A1 04 12 B5 67
C538: 55 57 A1 04 12 A1 04 12 54
C540: A1 04 12 A1 04 12 AA AA 05
C548: AA 00 FC 00 00 DC 00 00 CC
C550: FC 00 00 A8 00 00 AA 00 A0
C558: 00 AA 80 00 AF A0 00 AC 80
C560: E8 00 AC 3A 00 AC 0E 80 6B
C568: AC 03 A0 AC 03 A8 AC 03 C0
C570: A8 AC 03 AF AF FF A8 AE 7F
C578: AB AF AE AB A8 AE AB AF E0
C580: AE AB A8 AF FF AF AA AA 38
C588: A8 03 FF 00 03 DF 00 03 1A
C590: FF 00 00 00 07 01 0D 05 AA
C598: 20 0F 16 05 12 C1 CC CD 51
C5A0: C7 C7 C9 C9 B4 DD 58 DD 8C
C5A8: 58 DD 0D 3D FF 3D 0D 5D D0
C5B0: FF 5D 7F 02 00 00 00 0B 9A
C5B8: 00 00 00 01 00 07 05 05 CA
C5C0: 00 00 00 00 06 93 83 8F 6D
C5C8: 92 85 A0 84 8F 87 93 A0 51
C5D0: A0 8C 85 96 85 8C A0 8C 59
C5D8: 89 96 85 93 A0 B0 B0 B0 C4
C5E0: B0 B0 B0 A0 A0 84 8F 87 CF
C5E8: 83 81 94 83 88 85 92 A0 47
C5F0: 82 99 A0 82 8F 82 A0 82 65
C5F8: 8C 81 83 8B 8D 85 92 A0 5C
C600: A0 A8 83 A9 A0 B1 B9 B8 3B
C608: B6 A0 A0 10 12 05 13 13 4D
C610: 20 06 09 12 05 20 14 0F 99
C618: 20 13 14 01 12 14 20 14 BA
C620: 12 15 03 0B 20 20 20 20 D5
C628: 20 20 20 20 20 20 20 20 29
C630: 20 20 20 20 20 20 20 20 31
C638: 20 20 20 20 20 00 A2 00 7B
C640: BD 13 C2 9D 00 30 E8 E0 6B
C648: 00 D0 F5 A2 00 BD 13 C3 46
C650: 9D 00 31 E8 E0 00 D0 F5 AF
C658: A2 00 BD 13 C4 9D 00 32 60
C660: E8 E0 00 D0 F5 A2 00 BD 51
C668: 13 C5 9D 00 33 E8 E0 80 5C
C670: D0 F5 EA A2 00 A9 20 9D 2C
C678: 00 04 9D FF 04 9D FE 05 BF
C680: 9D E8 06 A9 00 9D 00 D8 2D
C688: 9D FF D8 9D FE D9 9D E8 FB
C690: DA E8 E0 00 D0 DF 8E 20 94
C698: D0 A2 00 A9 A0 9D 00 04 F7
C6A0: 9D A0 04 9D 40 05 9D E0 44
C6A8: 05 9D 80 06 9D 20 07 A9 40
C6B0: 08 9D 00 D8 9D A0 D8 9D E3
C6B8: 40 D9 9D E0 D9 9D 80 DA 24
C6C0: 9D 20 DB E8 E0 1E D0 D3 E6
C6C8: A2 00 A9 63 9D AC 04 9D 64
C6D0: EC 05 9D 2C 07 A9 00 9D DA
C6D8: AC D8 9D EC D9 9D 2C DB 68
C6E0: E8 E0 06 D0 E5 A2 00 A9 B3
C6E8: 63 9D 43 05 9D 56 05 9D C8
C6F0: 83 06 9D 96 06 A9 00 9D FB
C6F8: 43 D9 9D 56 D9 9D 83 DA DF
C700: 9D 96 DA E8 E0 05 D0 DF 8E
C708: A9 00 8D 86 02 A9 12 20 A3
C710: D2 FF A2 01 A0 1F 20 F0 57
C718: FF A9 20 20 D2 FF C8 C0 5E
C720: 27 D0 F3 E8 E0 14 D0 EC A7
C728: A9 92 20 D2 FF A9 0D 20 2E
C730: D2 FF A2 00 BD C5 C5 9D 8C
C738: C0 04 BD CB C5 9D 60 05 4F
C740: BD D1 C5 9D 00 06 BD D7 CE
C748: C5 9D A0 06 BD DD C5 9D 51
C750: E8 04 9D 88 05 9D 28 06 34
C758: 9D C8 06 E8 E0 06 D0 D4 3A
C760: A2 00 A9 0F 9D C0 D8 9D 90
C768: 60 D9 9D 00 DA 9D A0 DA 34
C770: A9 07 9D E8 D8 9D 88 D9 80
C778: 9D 28 DA 9D C8 DA E8 E0 24
C780: 06 D0 DF A9 12 20 D2 FF E5
C788: A9 0F 8D 86 02 A0 1E A2 B8
C790: 00 20 F0 FF A9 7A 20 D2 B8
C798: FF E8 E0 15 D0 F3 A9 92 78
C7A0: 20 D2 FF A9 0D 20 D2 FF 3D
C7A8: A2 00 A9 DA 9D 1F 04 9D 2E
C7B0: 3F 07 A9 0F 9D 1F D8 9D E2
C7B8: 3F DB E8 E0 09 D0 EB A2 06
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C7C0: 00 A9 DA 9D 4F 04 9D 3F 13
C7C8: 05 9D 2F 06 A9 0F 9D 4F 46
C7D0: D8 9D 3F D9 9D 2F DA 8A 92
C7D8: C9 F0 F0 07 18 69 28 AA DF
C7E0: 4C C1 C7 A9 DA 8D F7 06 C6
C7E8: A9 0F 8D F7 DA A2 00 BD 62
C7F0: E3 C5 9D C0 07 A9 0F 9D 56
C7F8: C0 DB E8 E0 28 D0 F0 60 A9
C800: AD EB 04 C9 B9 F0 06 EE 07
C808: EB 04 4C 49 C8 A9 B0 8D 3E
C810: EB 04 AD EA 04 C9 B9 F0 11
C818: 06 EE EA 04 4C 49 C8 A9 04
C820: B0 8D EA 04 8D EB 04 AD 78
C828: E9 04 C9 B9 F0 06 EE E9 69
C830: 04 4C 49 C8 A9 B0 8D E9 64
C838: 04 8D EA 04 8D EB 04 AD E3
C840: E8 04 C9 B9 F0 03 EE E8 7C
C848: 04 AD 8D 05 C9 B9 F0 04 05
C850: EE 8D 05 60 A9 B0 8D 8D A7
C858: 05 AD 8C 05 C9 B9 F0 04 15
C860: EE 8C 05 60 A9 B0 8D 8C B5
C868: 05 8D 8D 05 AD 8B 05 C9 95
C870: B9 F0 03 EE 8B 05 60 00 FD
C878: AD 00 DC 29 08 D0 44 AD F6
C880: F8 07 C9 CB F0 10 AD AD 72
C888: 02 8D F8 07 EE AC 02 AD 63
C890: AC 02 C9 05 F0 09 20 30 58
C898: C9 20 6B C9 4C 2F C9 A9 A6
C8A0: 00 8D AC 02 AD AD 02 C9 04
C8A8: C4 F0 0C CE AD 02 AD AD 44
C8B0: 02 8D F8 07 4C 96 C8 EE DA
C8B8: AD 02 AD AD 02 8D F8 07 53
C8C0: 4C 96 C8 AD 00 DC 29 04 24
C8C8: D0 44 AD F8 07 C9 CB F0 12
C8D0: 10 AD AB 02 8D F8 07 EE B8
C8D8: AC 02 AD AC 02 C9 05 F0 A3
C8E0: 09 20 30 C9 20 A1 C9 4C DB
C8E8: 2F C9 A9 00 8D AC 02 AD 75
C8F0: AB 02 C9 C1 F0 0C CE AB A1
C8F8: 02 AD AB 02 8D F8 07 4C 30
C900: E1 C8 EE AB 02 AD AB 02 A2
C908: 8D F8 07 4C E1 C8 AD 00 3A
C910: DC 29 02 D0 06 20 BE C9 97
C918: 4C 2F C9 AD 00 DC 29 01 12
C920: D0 03 20 27 CA AD 00 DC 90
C928: 29 10 D0 03 20 B4 CD 60 38
C930: A9 00 8D AE 02 AD 01 D0 97
C938: C9 DD F0 29 AD 01 D0 C9 43
C940: BD F0 22 AD 01 D0 C9 9D F7
C948: F0 1B AD 01 D0 C9 7D F0 0C
C950: 14 AD 01 D0 C9 5D F0 0D 09
C958: AD 01 D0 C9 3D F0 06 A9 7F
C960: 00 8D AE 02 60 A9 01 8D 37
C968: AE 02 60 AD AE 02 C9 00 A1
C970: F0 2E AD 01 D0 C9 DD D0 87
C978: 12 A5 02 C9 BA F0 03 4C F6
C980: 8B C9 C6 02 C6 02 A5 02 0F
C988: 8D 00 D0 A4 02 C8 C8 C0 DF
C990: F2 F0 06 84 02 8C 00 D0 5E
C998: 60 A0 F0 84 02 8C 00 D0 6E
C9A0: 60 AD AE 02 C9 00 F0 15 2F
C9A8: A4 02 88 88 C0 16 F0 06 2E
C9B0: 84 02 8C 00 D0 60 A0 18 AD
C9B8: 84 02 8C 00 D0 60 AD 01 AB
C9C0: D0 C9 DD F0 23 AD 01 D0 CC
C9C8: C9 BD 10 1D AD 01 D0 C9 C6
C9D0: 9D 10 25 AD 01 D0 C9 7D 6A
C9D8: 10 0F AD 01 D0 C9 5D 10 AE
C9E0: 17 AD 01 D0 C9 3D 10 01 8F
C9E8: 60 A5 02 C9 78 30 2D A5 36
C9F0: 02 C9 8D 10 27 4C 1D CA B5
C9F8: A5 02 C9 82 10 0F A5 02 B3
CA00: C9 32 30 18 A5 02 C9 3E F3
CA08: 10 12 4C 1D CA A5 02 C9 CF
CA10: D6 10 09 A5 02 C9 CA 30 6C
CA18: 03 4C 1D CA 60 EE 01 D0 70
CA20: EE 01 D0 EA EA EA 60 AD AF
CA28: 01 D0 C9 3D F0 23 AD 01 C3
CA30: D0 C9 BF 10 1D AD 01 D0 37
CA38: C9 9F 10 25 AD 01 D0 C9 20
CA40: 7F 10 0F AD 01 D0 C9 5F 87
CA48: 10 17 AD 01 D0 C9 3F 10 08
CA50: 01 60 A5 02 C9 78 30 37 03
CA58: A5 02 C9 8D 10 31 4C 86 6B
CA60: CA A5 02 C9 82 10 0F A5 E3
CA68: 02 C9 32 30 22 A5 02 C9 2A
CA70: 3E 10 1C 4C 86 CA A5 02 20
CA78: C9 D6 10 13 A5 02 C9 CA 78
CA80: 30 0D 4C 86 CA 60 CE 01 8B
CA88: D0 CE 01 D0 EA EA EA 60 1B
CA90: 00 00 00 00 A9 06 8D 10 DD
CA98: D0 8D 15 D0 A9 58 8D 04 70
CAA0: D0 8D 02 D0 A9 DD 8D 03 E9
CAA8: D0 8D 05 D0 A9 CC 8D F9 DA
CAB0: 07 AD 02 D0 C9 28 F0 09 24
CAB8: CE 02 D0 20 97 CB 4C B1 DB
CAC0: CA AD 02 D0 C9 00 F0 0C D2
CAC8: CE 02 D0 CE 04 D0 20 97 C5
CAD0: CB 4C C1 CA A9 04 8D 10 C0
CAD8: D0 A9 FF 8D 02 D0 CE 04 86
CAE0: D0 AD 04 D0 C9 00 F0 0C FA
CAE8: CE 02 D0 CE 04 D0 20 97 E5
CAF0: CB 4C E1 CA A9 7F 8D 15 81
CAF8: D0 4C 14 CD 00 A9 C0 8D EF
CB00: F9 07 A9 06 8D 15 D0 AD D1
CB08: 04 D0 C9 2E F0 0C EE 04 C4
CB10: D0 EE 02 D0 20 97 CB 4C 72
CB18: 07 CB A9 00 8D 02 D0 A9 9E
CB20: 06 8D 10 D0 EE 04 D0 AD 06
CB28: 04 D0 C9 58 F0 0C EE 04 0F
CB30: D0 EE 02 D0 20 97 CB 4C 92
CB38: 27 CB A9 02 8D 15 D0 A9 F3
CB40: 02 8D 10 D0 AD 02 D0 C9 FA
CB48: 58 F0 09 EE 02 D0 20 97 14
CB50: CB 4C 44 CB AD 2D 06 C9 23
CB58: B9 F0 06 EE 2D 06 4C 70 E7
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CB60: CB A9 B0 8D 2D 06 AD 2C 21
CB68: 06 C9 B9 F0 03 EE 2C 06 07
CB70: A2 00 BD 0B C6 9D 73 07 BA
CB78: E8 E0 19 D0 F5 AD 00 DC AC
CB80: 29 10 D0 F9 A2 00 BD 24 09
CB88: C6 9D 73 07 E8 E0 19 D0 1B
CB90: F5 4C 94 CA 00 00 00 A9 DB
CB98: 00 8D C1 02 A2 00 E8 E0 56
CBA0: 00 D0 FB EE C1 02 AD C1 8F
CBA8: 02 C9 05 D0 EF 60 AD 1E 66
CBB0: D0 8D BC 02 C9 41 F0 32 FB
CBB8: C9 21 F0 31 C9 11 F0 30 C1
CBC0: C9 09 F0 2F C9 51 F0 2E ED
CBC8: C9 49 F0 2A C9 31 F0 26 09
CBD0: C9 29 F0 22 C9 19 F0 1E C8
CBD8: C9 03 F0 0B A9 00 8D 1E F6
CBE0: D0 8D BC 02 4C F9 CB 4C 5C
CBE8: E2 CC 4C FC CB 4C 1F CC E5
CBF0: 4C 42 CC 4C 65 CC 4C 88 9F
CBF8: CC 60 00 00 AD F8 07 C9 9D
CC00: C6 D0 F3 AD C0 02 D0 14 E0
CC08: A2 00 CE 15 D0 E8 E0 40 69
CC10: D0 F8 A9 CB 8D F8 07 A9 86
CC18: 01 8D C0 02 4C DC CB AD 0C
CC20: F8 07 C9 C3 D0 D0 AD BF BC
CC28: 02 D0 14 A2 00 CE 15 D0 66
CC30: E8 E0 20 D0 F8 A9 CB 8D E6
CC38: F8 07 A9 01 8D BF 02 4C 7E
CC40: DC CB AD F8 07 C9 C6 D0 F7
CC48: AD AD BE 02 D0 14 A2 00 EB
CC50: CE 15 D0 E8 E0 10 D0 F8 A8
CC58: A9 CB 8D F8 07 A9 01 8D 93
CC60: BE 02 4C DC CB AD F8 07 C3
CC68: C9 C3 D0 8A AD BD 02 D0 8F
CC70: 14 A2 00 CE 15 D0 E8 E0 A5
CC78: 08 D0 F8 A9 CB 8D F8 07 4D
CC80: A9 01 8D BD 02 4C DC CB 6D
CC88: A9 00 8D C1 02 A2 08 8E BC
CC90: 27 D0 E8 E0 08 D0 F8 EE 13
CC98: C1 02 AD C1 02 C9 64 D0 CC
CCA0: EC AD CD 06 C9 B0 F0 10 8A
CCA8: CE CD 06 A9 DD 8D 01 D0 32
CCB0: A9 B4 8D 00 D0 85 02 60 55
CCB8: A2 00 BD 94 C5 9D 3B 06 52
CCC0: E8 E0 09 D0 F5 A2 00 8E 8B
CCC8: 00 DC BD 0B C6 9D 73 07 4D
CCD0: E8 E0 19 D0 F5 AD 00 DC 05
CCD8: C9 6F D0 F9 20 06 C2 4C 12
CCE0: 00 C0 AD F8 07 C9 CB F0 D5
CCE8: 01 60 A9 C4 8D F8 07 20 66
CCF0: 00 C8 EE F8 02 AD F8 02 4C
CCF8: C9 04 F0 01 60 A9 00 8D 50
CD00: 18 D4 AA 8D F8 02 9D BD 7B
CD08: 02 E8 E0 04 D0 F8 C6 4B B3
CD10: EA 4C FD CA A9 00 8D C1 09
CD18: 02 A2 00 E8 E0 00 D0 FB 53
CD20: EE C1 02 AD C1 02 C9 05 13
CD28: D0 EF A5 4B C9 00 D0 04 78
CD30: A9 01 85 4B 20 12 C0 20 BE
CD38: 78 C8 A9 0F 8D 18 D4 20 CC
CD40: AE CB 4C 14 CD EA A2 00 76
CD48: BD A4 C5 9D 00 D0 E8 E0 A8
CD50: 0E D0 F5 A2 00 BD B2 C5 FD
CD58: 9D 1C D0 E8 E0 12 D0 F5 85
CD60: A2 00 BD 9D C5 9D F8 07 C1
CD68: E8 E0 07 D0 F5 A9 06 8D 3D
CD70: 10 D0 A2 00 A9 01 95 FB 30
CD78: E8 E0 04 D0 F9 A2 00 8A 3E
CD80: 9D A7 02 9D 00 D4 E8 E0 04
CD88: 1A D0 F5 8D F8 02 A9 0A A5
CD90: 8D 05 D4 8D 06 D4 A9 01 0B
CD98: 8D EE 02 A9 FF 85 FE A9 EE
CDA0: B4 85 02 A9 19 85 4B EA 5B
CDA8: A9 C1 8D AB 02 A9 C4 8D 4B
CDB0: AD 02 60 00 AD F8 07 C9 38
CDB8: CB F0 11 C9 C3 10 08 A9 D5
CDC0: C3 8D F8 07 4C CC CD A9 A2
CDC8: C6 8D F8 07 A9 00 8D AF 04
CDD0: 02 A2 00 E8 E0 00 D0 FB 0C
CDD8: EE AF 02 AD AF 02 C9 03 A5
CDE0: D0 EF 20 AE CB AD F8 07 E9
CDE8: C9 CB F0 03 CE F8 07 A9 EA
CDF0: 00 8D 1E D0 60 00 00 00 CD
CDF8: C6 FD A5 FD D0 22 A9 10 0E
CE00: 8D 04 D4 A9 01 85 FD CE 63
CE08: EE 02 AD EE 02 D0 11 E6 60
CE10: FE A6 FE E0 24 D0 1B A2 48
CE18: FF 86 FE A9 01 8D EE 02 C6
CE20: A9 00 8D EF 02 EE EF 02 2A
CE28: AD EF 02 C9 03 D0 F6 4C A8
CE30: 31 EA A9 11 8D 04 D4 BD 2B
CE38: 54 CE 8D 00 D4 BD 7C CE C6
CE40: 8D 01 D4 BD A4 CE 85 FD 58
CE48: 18 65 FD 8D EE 02 4C 20 AE
CE50: CE EA EA EA 8F 18 8F E1 F8
CE58: 0C DA 8F E1 8F E9 8F 4E 08
CE60: DA 8F 68 4E DA 8F 8F 18 93
CE68: 8F E1 0C DA 8F E1 8F E9 AB
CE70: 8F 4E DA 8F 68 E1 E9 0C F8
CE78: 00 FF 00 FF 0A 0E 0A 08 A2
CE80: 07 0B 0A 08 0A 07 0A 0D CC
CE88: 0B 0A 09 0D 0B 0A 0A 0E E0
CE90: 0A 08 07 0B 0A 08 0A 07 D7
CE98: 0A 0D 0B 0A 09 08 07 07 E3
CEA0: 00 FE 00 FE 07 07 07 07 BA
CEA8: 0B 04 04 04 07 07 07 07 DB
CEB0: 07 07 07 07 07 11 07 07 F2
CEB8: 07 07 0B 04 04 04 07 07 EB
CEC0: 07 07 07 07 07 07 07 1B 0D
```

MINE CANYON
FROM PAGE 18

Beginning address in hex: C000
Ending address in hex: C857
SYS to Start: 49152
***Flankspeed* required for entry! See page 89.**

```
C000: 20 18 E5 A9 8E 20 D2 FF 49
C008: A9 08 20 D2 FF A2 00 A9 F8
C010: 20 9D 00 88 9D 00 89 9D 1B
C018: 00 8A 9D 00 8B E8 D0 F1 77
C020: A2 00 A9 08 9D 00 D8 9D 88
C028: 00 D9 9D 00 DA 9D 00 DB F3
C030: E8 D0 F1 A9 0C 8D 20 D0 10
C038: A9 0D 8D 21 D0 AD 1E D0 0B
C040: AD 1F D0 A2 00 A9 00 9D C7
C048: 00 D4 E8 E0 19 D0 F8 A9 73
C050: 80 8D 18 D4 A9 FF 8D 0E 90
C058: D4 8D 0F D4 A9 81 8D 12 69
C060: D4 20 05 C6 A9 47 8D 11 B0
C068: C8 A9 00 8D 15 C8 85 8B 57
C070: 85 8C 85 8D A9 01 8D 13 E0
C078: C8 8D 16 C8 A9 D8 8D 16 D3
C080: D0 A9 2F 85 00 A9 3F 8D 26
C088: 02 DD A9 95 8D 00 DD A9 BC
C090: 20 8D 18 D0 A9 88 8D 88 6F
C098: 02 A9 10 8D 11 D0 A9 7F EC
C0A0: 8D 0D DC A9 33 85 01 A2 1E
C0A8: 00 BD 00 D0 9D 00 80 BD 13
C0B0: 00 D1 9D 00 81 BD 00 D2 32
C0B8: 9D 00 82 BD 00 D3 9D 00 08
C0C0: 83 BD 00 D4 9D 00 84 BD B6
C0C8: 00 D5 9D 00 85 BD 00 D6 56
C0D0: 9D 00 86 BD 00 D7 9D 00 28
C0D8: 87 E8 D0 CD A9 37 85 01 4F
C0E0: A9 81 8D 0D DC A2 00 BD E3
C0E8: 5D C6 9D D8 80 E8 E0 18 E5
C0F0: D0 F5 A2 00 BD 15 C7 9D 92
C0F8: 00 8C E8 E0 3F D0 F5 A2 F7
C100: 00 BD 54 C7 9D 40 8C E8 2D
C108: E0 3F D0 F5 A2 00 BD 93 E2
C110: C7 9D 80 8C E8 E0 3F D0 5C
C118: F5 A2 00 BD D2 C7 9D C0 67
C120: 8C E8 E0 3F D0 F5 A9 31 57
C128: 8D F9 8B A9 32 8D FA 8B 2B
C130: A9 30 8D FB 8B A9 00 8D 56
C138: 10 D0 A9 00 8D 1D D0 A9 E7
C140: 00 8D 17 D0 A2 AA A0 50 F3
C148: 8E 06 D0 8C 07 D0 A2 1B CF
C150: A0 E0 8E 02 D0 8C 03 D0 93
C158: A2 33 A0 E0 8E 04 D0 8C 9F
C160: 05 D0 A9 0E 8D 2A D0 A9 20
C168: 00 8D 25 D0 A9 02 8D 26 4B
C170: D0 A9 01 8D 28 D0 8D 29 29
C178: D0 A9 0E 8D 1C D0 A9 00 25
C180: 8D 1B D0 A9 0E 8D 15 D0 25
C188: A9 5A A2 C2 8D 18 03 8E 29
C190: 19 03 A9 7F 8D 0D DD A9 F7
C198: 82 8D 0D DD A9 63 A2 02 45
C1A0: 8D 04 DD 8E 05 DD A9 11 3C
C1A8: 8D 0E DD A9 10 A2 00 8D 0C
C1B0: 06 DD 8E 07 DD A9 51 8D 90
C1B8: 0F DD A5 91 C9 7F D0 08 FE
C1C0: A9 04 8D 88 02 4C 66 FE 38
C1C8: AD 00 DC 29 1F C9 1F F0 75
C1D0: 4D C9 1E D0 06 20 A0 C2 60
C1D8: 4C 1E C2 C9 1D D0 06 20 E3
C1E0: AF C2 4C 1E C2 C9 17 D0 32
C1E8: 06 20 BE C2 4C 1E C2 C9 87
C1F0: 1B D0 06 20 EC C2 4C 1E 1D
C1F8: C2 C9 16 D0 06 20 BE C2 14
C200: 4C 1E C2 C9 15 D0 06 20 03
C208: BE C2 4C 1E C2 C9 1A D0 6B
C210: 06 20 EC C2 4C 1E C2 C9 DC
C218: 19 D0 03 20 EC C2 20 BE B3
C220: C4 A9 7F 8D 0D DD AD 1E 52
C228: D0 29 08 F0 1B AD 16 C8 C2
C230: C9 04 D0 06 20 95 C5 4C 9C
C238: 00 C0 20 D1 C4 EE 16 C8 7D
C240: A9 0E 8D 15 D0 4C 52 C2 CC
C248: AD 1F D0 29 08 F0 03 4C 57
C250: 2D C2 A9 82 8D 0D DD 4C 31
C258: BA C1 48 8A 48 98 48 A9 7A
C260: 0E 8D 01 D4 A9 0F 8D 08 20
C268: D4 A9 11 8D 04 D4 8D 0B F6
C270: D4 20 BE C3 20 BE C3 20 AA
C278: 1A C3 20 BE C3 20 BE C3 9B
C280: A9 0F 8D 01 D4 A9 0E 8D E1
C288: 08 D4 EE 22 D0 EE 11 C8 10
C290: AD 11 C8 C9 48 D0 06 20 21
C298: 5E C3 20 7F C5 4C 51 FE BC
C2A0: AC 07 D0 C0 36 F0 07 88 9C
C2A8: 8C 07 D0 20 BE C4 60 AC BD
C2B0: 07 D0 C0 EC F0 07 C8 8C 83
C2B8: 07 D0 20 BE C4 60 AE 06 49
C2C0: D0 AD 10 D0 29 08 F0 0B 4D
C2C8: E0 45 F0 1F E8 8E 06 D0 4D
C2D0: 4C EB C2 E0 FF D0 10 AD 3B
C2D8: 10 D0 09 08 8D 10 D0 A2 DB
C2E0: 00 8E 06 D0 4C EB C2 E8 2A
C2E8: 8E 06 D0 60 AE 06 D0 AD E1
C2F0: 10 D0 29 08 D0 0B E0 15 D4
C2F8: F0 1F CA 8E 06 D0 4C 19 9E
C300: C3 E0 00 D0 10 AD 10 D0 14
C308: 29 F7 8D 10 D0 A2 FF 8E C8
C310: 06 D0 4C 19 C3 CA 8E 06 6F
C318: D0 60 AD 11 D0 10 FB 29 0E
C320: 07 D0 0A A9 07 0D 11 D0 A1
C328: 8D 11 D0 D0 06 CE 11 D0 1F
C330: 4C 5D C3 A9 87 8D 41 C3 61
C338: 8D 44 C3 A2 04 A0 40 B9 0F
C340: E8 8B 99 C0 8B C8 D0 F7 2C
C348: EE 41 C3 EE 44 C3 CA D0 CE
C350: EE A2 00 A9 20 9D C0 8B 95
```

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C358: E8 E0 28 D0 F8 60 A9 00 1E
C360: 8D 11 C8 AD 1B D4 29 03 91
C368: AA EC 12 C8 F0 F5 8D 12 61
C370: C8 A8 A9 07 0D 11 D0 8D 0F
C378: 11 D0 A2 00 C0 00 D0 0E 9C
C380: BD 75 C6 9D C0 8B E8 E0 2E
C388: 28 D0 F5 4C BD C3 C0 01 07
C390: D0 0E BD 9D C6 9D C0 8B 7B
C398: E8 E0 28 D0 F5 4C BD C3 1F
C3A0: C0 02 D0 0E BD C5 C6 9D 2A
C3A8: C0 8B E8 E0 28 D0 F5 4C F9
C3B0: BD C3 BD ED C6 9D C0 8B 8E
C3B8: E8 E0 28 D0 F5 60 AD 13 92
C3C0: C8 C9 02 F0 07 C9 01 F0 09
C3C8: 37 4C 61 C4 AD 11 D0 10 12
C3D0: FB CE 03 D0 CE 05 D0 AD C1
C3D8: 03 D0 C9 23 B0 08 A9 EA E6
C3E0: 8D 03 D0 8D 05 D0 EE 15 A9
C3E8: C8 AD 15 C8 C9 18 D0 0D FC
C3F0: A9 00 8D 15 C8 AD 14 C8 90
C3F8: 49 01 8D 13 C8 4C BD C4 7B
C400: AD 11 D0 10 FB EE 02 D0 5D
C408: EE 04 D0 AD 10 D0 29 06 89
C410: F0 07 C9 04 F0 1D 4C 4D 7D
C418: C4 AD 04 D0 C9 FF D0 32 2C
C420: AD 10 D0 09 04 8D 10 D0 2A
C428: A2 00 8E 04 D0 EE 02 D0 EF
C430: 4C BD C4 AD 02 D0 C9 FF 49
C438: D0 18 AD 10 D0 09 02 8D 48
C440: 10 D0 A2 00 8E 02 D0 EE 14
C448: 04 D0 4C BD C4 AD 04 D0 6E
C450: C9 36 D0 69 A9 02 8D 13 D6
C458: C8 A9 01 8D 14 C8 4C BD 40
C460: C4 AD 11 D0 10 FB CE 02 91
C468: D0 CE 04 D0 AD 10 D0 29 94
C470: 06 C9 06 F0 07 C9 04 F0 FC
C478: 1B 4C AC C4 AD 02 D0 D0 A2
C480: 3C AD 10 D0 49 02 8D 10 34
C488: D0 A2 FF 8E 02 D0 CE 04 30
C490: D0 4C BD C4 AD 04 D0 D0 83
C498: 24 AD 10 D0 49 04 8D 10 36
C4A0: D0 A2 FF 8E 04 D0 CE 02 48
C4A8: D0 4C BD C4 AD 04 D0 C9 94
C4B0: 3A D0 0A A9 02 8D 13 C8 DA
C4B8: A9 00 8D 14 C8 60 A0 96 64
C4C0: 88 D0 FD 60 20 BE C4 20 3C
C4C8: BE C4 20 BE C4 20 BE C4 93
C4D0: 60 A9 33 8D FB 8B A2 FA C0
C4D8: 8E 06 D4 8E 0D D4 A9 8F EB
C4E0: A2 81 8D 18 D4 8E 04 D4 E6
C4E8: 8E 0B D4 A2 FF A9 02 8D 33
C4F0: 01 D4 8D 08 D4 20 C4 C4 DA
C4F8: A9 00 8D 01 D4 8D 08 D4 70
C500: 20 C4 C4 EE 2A D0 E0 DC 51
C508: D0 08 A9 80 8D 04 D4 8D FE
C510: 0B D4 CA D0 D8 A9 00 8D 9B
C518: 15 D0 A2 00 A9 20 9D 00 08
C520: 88 9D 00 89 9D 00 8A E8 E0
C528: D0 F4 A2 00 A9 20 9D 00 F7
C530: 8B E8 E0 E8 D0 F8 A9 02 E3
C538: 8D 13 C8 A9 00 8D 14 C8 B5
C540: A9 00 8D 15 C8 A2 00 8E 86
C548: 10 D0 A2 14 A9 29 A0 EA 3E
C550: 8E 02 D0 8D 04 D0 8C 03 A3
C558: D0 8C 05 D0 A2 AA A0 50 C9
C560: 8E 06 D0 8C 07 D0 A9 0E E1
C568: 8D 2A D0 A9 47 8D 11 C8 49
C570: A9 30 8D FB 8B 20 05 C6 4B
C578: AD 1E D0 AD 1F D0 60 F8 0C
C580: 18 A5 8D 69 10 85 8D A5 FD
C588: 8C 69 00 85 8C A5 8B 69 2B
C590: 00 85 8B D8 60 20 D1 C4 91
C598: A9 07 8D 20 D0 8D 21 D0 47
C5A0: A9 C8 8D 16 D0 A2 0B A0 D5
C5A8: 11 18 20 F0 FF A2 00 BD 43
C5B0: 17 C8 20 D2 FF E8 E0 17 64
C5B8: D0 F5 A9 12 20 D2 FF A5 D3
C5C0: 8B 20 39 C6 A5 8C 20 2D EB
C5C8: C6 A5 8C 20 39 C6 A5 8D 15
C5D0: 20 2D C6 A5 8D 20 39 C6 38
C5D8: A9 92 20 D2 FF A2 12 A0 5D
C5E0: 02 18 20 F0 FF A2 00 BD 6C
C5E8: 2F C8 20 D2 FF E8 E0 24 C1
C5F0: D0 F5 A5 91 C9 7F D0 03 0C
C5F8: 4C C0 C1 AD 00 DC 29 1F 9A
C600: C9 0F D0 EE 60 A9 FF 8D 30
C608: 00 D4 A9 9F 8D 07 D4 A9 39
C610: F1 8D 06 D4 8D 0D D4 A9 83
C618: 11 8D 04 D4 8D 0B D4 A9 A6
C620: 8F 8D 18 D4 A9 10 8D 04 75
C628: D4 8D 0B D4 60 4A 4A 4A A9
C630: 4A 29 0F 09 30 20 D2 FF DE
C638: 60 29 0F 09 30 20 D2 FF FC
C640: 60 4D 49 4E 45 20 43 41 6F
C648: 4E 59 4F 4E 20 4A 4F 48 8F
C650: 4E 20 4B 52 55 54 43 48 91
C658: 20 31 39 38 36 00 00 03 54
C660: 0D 0D 03 00 00 3C D7 55 E6
C668: 55 55 55 D7 3C 00 00 C0 3D
C670: 70 70 C0 00 00 20 20 20 72
C678: 20 1B 1C 1D 1B 1C 1D 1B 5C
C680: 1C 1D 1B 1C 1D 1B 1C 1D 62
C688: 1B 1C 1D 1B 1C 1D 1B 1C 68
C690: 1D 1B 1C 1D 1B 1C 1D 1B 71
C698: 1C 1D 1B 1C 1D 1B 1C 1D 7A
C6A0: 1B 1C 1D 1B 1C 1D 1B 1C 80
C6A8: 1D 20 20 20 20 20 20 20 A6
C6B0: 1B 1C 1D 1B 1C 1D 1B 1C 90
C6B8: 1D 1B 1C 1D 1B 1C 1D 1B 99
C6C0: 1C 1D 1B 1C 1D 1B 1C 1D A2
C6C8: 1B 1C 1D 1B 1C 1D 1B 1C A8
C6D0: 1D 1B 1C 1D 1B 1C 1D 20 B6
C6D8: 20 20 20 20 20 20 1B 1C D0
C6E0: 1D 1B 1C 1D 1B 1C 1D 1B C1
C6E8: 1C 1D 1B 1C 1D 1B 1C 1D CA
C6F0: 1B 1C 1D 1B 1C 1D 1B 1C D0
```

IMPORTANT! Letters on white background are **Bug Repellent** line codes. **Do not enter them!** Pages 87-89 explain these codes and provide other essential information on entering ***Ahoy!*** programs. Refer to these pages **before** entering any programs!

```
C6F8: 1D 1B 1C 1D 1B 1C 1D 1B D9
C700: 1C 1D 1B 1C 1D 1B 1C 1D E1
C708: 1B 1C 1D 1B 1C 1D 20 20 F0
C710: 20 20 20 20 20 01 99 00 4B
C718: 06 AA 40 06 AA 40 0A AA AE
C720: 80 06 AA 40 06 56 40 0A 38
C728: 76 80 06 56 40 06 AA 40 AC
C730: 01 99 00 00 00 00 00 00 CA
C738: 00 00 00 00 00 00 00 00 38
C740: 00 00 00 00 00 00 00 00 40
C748: 00 00 00 00 00 00 00 00 48
C750: 00 00 00 00 00 00 01 00 51
C758: 00 05 00 00 19 00 00 69 DF
C760: 00 01 A9 00 06 A9 00 1A D4
C768: A9 00 6A A9 41 AA A9 46 02
C770: AA A9 5A AA A9 6A AA A9 32
C778: 6A AA A9 6A AA A9 6A AA 0B
C780: A9 7B BB B9 6E EE ED 40 A6
C788: 00 00 40 00 00 40 00 00 09
C790: 00 00 00 40 00 00 50 00 21
C798: 00 64 00 00 69 00 00 6A D0
C7A0: 40 00 6A 90 00 6A A4 00 EA
C7A8: 6A A9 00 6A AA 41 6A AA 28
C7B0: 91 6A AA A5 6A AA A9 6A 26
C7B8: AA A9 6A AA A9 6A AA A9 8A
C7C0: 6E EE ED 7B BB B9 00 00 FC
C7C8: 01 00 00 01 00 00 01 00 CB
C7D0: 00 00 00 54 00 02 21 40 88
C7D8: 08 8A 08 05 24 90 52 8A 0A
C7E0: 2A 25 51 44 8A 24 95 54 5E
C7E8: 95 22 84 4A 89 22 22 10 4D
C7F0: 50 89 4A 2A 24 94 12 52 5C
C7F8: 50 04 A8 88 04 45 40 00 08
C800: 91 00 00 00 00 00 00 00 91
C808: 00 00 00 00 00 00 00 00 08
C810: 00 00 00 01 00 00 01 53 65
C818: 43 4F 52 45 0D 20 20 20 AF
C820: 20 20 20 20 20 20 20 20 21
C828: 20 20 20 20 20 20 20 50 59
C830: 52 45 53 53 20 54 48 45 70
C838: 20 46 49 52 45 20 42 55 37
C840: 54 54 4F 4E 20 54 4F 20 6A
C848: 50 4C 41 59 20 41 47 41 69
C850: 49 4E 2E 00 00 00 00 00 16
```

SPEECH64

FROM PAGE 39

```
·10 REM SPEECH64                                        MN
·20 REM BY SCOTT C. BAGGS                               IH
·30 GOSUB 4000 :REM POKE ML ROUTINES                    JJ
·35 POKE49358,5 : REM  SET PITCH                        DO
·40 PRINT CHR$(147): REM CLEAR SCREEN                   EG
·50 PRINT TAB(14);"* SPEECH64 *"                        OM
·52 PRINT:PRINT:PRINT                                   EF
·54 PRINT TAB(14);"1  RECORD WORD":PRINT
    TAB(14);"2  PLAYBACK WORD"                          GE
·55 PRINT TAB(14);"3  LOAD DATA   ":PRINT
    TAB(14);"4  SAVE DATA[4" "]"                        HP
·58 GETA$:IFA$=""THENGOTO  58                           NN
·59 IFA$>"4"THENGOTO  58                                KN
·60 ON VAL(A$) GOSUB 200,70,400,1000                    BD
·65 GOTO40                                              PE
·70 REM  PLAYBACK PRAMETERS                             KP
·100 SRT=64 : GOSUB110                                  IH
·102 POKE53265,PEEK(53265)AND239 :REM BLA
NK SCREEN                                               FF
·105 SYS49287  : REM PLAYBACK                           LP
·106 POKE53265,PEEK(53265)OR16 :REM ENABL
E SCREEN                                                IG
·108 RETURN                                             IM
·110 A=49154 : REM  $C002                               NA
·120 POKEA,0:POKEA+1,SRT :POKEA+3,SRT
    +24  :POKEA+2,0 : RETURN                            GG
·200 REM RECORD                                         FH
·210 PRINT "RECORD - PRESS PLAY ON CASSET
TE"                                                     DA
·215 IF(PEEK(1)AND16)=16THEN 215 :REM WAI
T                                                       JH
·220 SRT=64: GOSUB110                                   IH
·230 PRINT "START TAPE":
    SYS49200                                            MO
·240 RETURN                                             IM
·400 REM  LOAD DATA                                     NB
·420 INPUT "FILENAME";FLN$                              CE
·425 INPUT"[DOWN][DOWN]DEVICE NUMBER #8[3
"[LEFT]"]";DV                                           OC
·430 LOAD+FLN$,DV,1                                     HF
·480 RETURN                                             IM
·1000 PRINT"[CLEAR][DOWN][DOWN]SAVE SPEEC
H DATA"                                                 OL
·1005 INPUT"[DOWN][DOWN]DEVICE NUMBER #8[
3"[LEFT]"]";DV                                          OC
·1010 INPUT"[DOWN][DOWN]FILE TO SAVE ";F$
:IFF$=""THEN1010                                        LL
·1015 REM LOC. OF F$                                    KM
·1020 POKE187,PEEK(71):POKE188,PEEK(72)                 GA
·1025 REM CSLC. POINTER TO F$                           CA
·1030 FA=PEEK(187)+256*PEEK(188)                        IO
·1035 REM SET FILENAME LENGTH                           JO
·1040 POKE183,PEEK(FA)                                  PJ
·1055 REM SET FN. POINTER                               GE
·1060 POKE187,PEEK(FA+1):POKE188,PEEK(FA+
2)                                                      BA
·1070 REM                                               JD
·1080 SA$="4[3"0"]"                                     HE
·1090 N$=SA$:GOSUB2000:SL=BL:SH=BH                      IA
·1095 REM                                               JD
·1100 EA$="5800"                                        GF
·1110 N$=EA$:GOSUB2000:EL=BL:EH=BH                      JG
·1115 REM SET STRT ADD. PTR.                            OK
·1120 POKE251,SL:POKE252,SH                             HK
```

```
1125 REM SET DEV. & S.A.                    ME
1130 POKE186,DV:POKE185,1                   NK
1135 REM SET .A,.X,&.Y                      JL
1140 POKE780,251:POKE781,EL:POKE782,EH      IC
1150 SYS65496:REM GO DO SAVE ($FFD8)        GN
1160 RETURN                                 IM
1999 REM                                    JD
2000 REM HEX -> 2 BYTES (DEC.)              BL
2010 :                                      DI
2020 N=0                                    DD
2030 FORI=1TOLEN(N$)                        OB
2040 :X=ASC(MID$(N$,I))-48                  MJ
2050 :N=16*N+X+7*(X>9)                      MN
2060 NEXT                                   IA
2100 BH=INT(N/256):BL=N-256*BH              FN
2110 RETURN                                 IM
4000 FORI=49152 TO 49371                    EH
4010 READ Q                                 NK
4020 POKE I,Q                               FO
4030 NEXT I                                 MN
4040 RETURN                                 IM
4090 REM DATA FOR ML ROUTINES               LO
5000 DATA 0 , 255 , 0 , 64 , 0              OD
5010 DATA 88 , 5 , 255 , 0 , 255            HP
5020 DATA 0 , 255 , 0 , 0 , 0               JI
5030 DATA 255 , 0 , 1 , 2 , 4               LN
5040 DATA 8 , 16 , 32 , 64 , 128            CN
5050 DATA 255 , 0 , 255 , 0 , 255           MA
5060 DATA 0 , 255 , 0 , 254 , 253           FL
5070 DATA 251 , 247 , 239 , 223 , 191       FF
5080 DATA 127 , 255 , 187 , 255 , 3         AO
5090 DATA 255 , 32 , 255 , 173 , 17         AJ
5100 DATA 208 , 41 , 239 , 141 , 17         OI
5110 DATA 208 , 120 , 32 , 192 , 192        AE
5120 DATA 173 , 13 , 220 , 240 , 251        FP
5130 DATA 162 , 16 , 173 , 13 , 220         NA
5140 DATA 208 , 6 , 202 , 240 , 241         MG
5150 DATA 76 , 67 , 192 , 162 , 8           KH
5160 DATA 32 , 205 , 192 , 173 , 13         LK
5170 DATA 220 , 41 , 16 , 240 , 10          IG
5180 DATA 177 , 2 , 29 , 16 , 192           KB
5190 DATA 145 , 2 , 76 , 110 , 192          KG
5200 DATA 177 , 2 , 61 , 32 , 192           IP
5210 DATA 145 , 2 , 76 , 110 , 192          KG
5220 DATA 202 , 208 , 223 , 200 , 208       FN
5230 DATA 218 , 230 , 3 , 165 , 3           HE
5240 DATA 205 , 5 , 192 , 208 , 209         KA
5250 DATA 88 , 173 , 17 , 208 , 9           IC
5260 DATA 16 , 141 , 17 , 208 , 96          LH
5270 DATA 120 , 32 , 192 , 192 , 162        BD
5280 DATA 8 , 32 , 205 , 192 , 177          LE
5290 DATA 2 , 61 , 16 , 192 , 240           IK
5300 DATA 12 , 169 , 15 , 141 , 24          JO
5310 DATA 212 , 76 , 159 , 192 , 234        CM
5320 DATA 76 , 175 , 192 , 169 , 0          LP
5330 DATA 141 , 24 , 212 , 76 , 171         JM
5340 DATA 192 , 234 , 76 , 175 , 192        CD
5350 DATA 202 , 208 , 219 , 200 , 208       BK
5360 DATA 214 , 230 , 3 , 165 , 3           HA
5370 DATA 205 , 5 , 192 , 208 , 205         JM
5380 DATA 88 , 96 , 173 , 2 , 192           II
5390 DATA 133 , 2 , 173 , 3 , 192           FF
5400 DATA 133 , 3 , 160 , 0 , 96            BG
5410 DATA 169 , 5 , 141 , 0 , 192           IF
5420 DATA 206 , 0 , 192 , 173 , 0           KB
5430 DATA 192 , 208 , 248 , 96 , 255        DD
```

THE LAST NINJA

FROM PAGE 85

Starting address in hex: C000
Ending address in hex: CFFF
SYS to Start: 49152
Flankspeed **required for entry! See page 89.**

```
C000: A9 00 85 02 20 DB CB AD A6
C008: 16 D0 09 08 8D 16 D0 20 94
C010: 34 C9 20 F9 C5 20 6D C9 45
C018: AD 11 D0 10 FB AD 1E D0 50
C020: 20 C4 C9 AD 11 D0 10 FB 6A
C028: AD 1E D0 29 9F 8D B1 02 CE
C030: 20 5A C0 AD B2 02 D0 1C BA
C038: 20 FE C2 A2 C8 CA D0 FD 1F
C040: 20 70 C4 A5 02 C9 0B F0 03
C048: BE AD 0A D0 38 C9 9D 90 BF
C050: B6 4C 23 C0 20 65 C3 4C CC
C058: 3B C0 AD 00 DC 8D A8 02 17
C060: AD A9 02 D0 03 4C B2 C1 4E
C068: 29 01 F0 49 CE AF 02 D0 1E
C070: 43 A9 14 8D AF 02 AD AA 09
C078: 02 8D 01 D4 D0 1A A9 FE 71
C080: 8D FA 07 A9 A1 8D 05 D0 BE
C088: A9 FE 2D A9 02 8D A9 02 43
C090: A9 00 8D 04 D4 4C B2 C1 61
C098: AE AA 02 CA BD 08 CA 8D DC
C0A0: 05 D4 8D FA 07 AD 05 D0 8D
C0A8: 8D 00 D4 38 E9 0A 8D 05 C9
C0B0: D0 8E AA 02 60 AD A9 02 76
C0B8: 29 02 F0 55 20 FC C7 CE DD
C0C0: AF 02 D0 4C A9 19 8D AF 8F
C0C8: 02 AD AA 02 10 02 A9 01 E1
C0D0: 8D 01 D4 AD AA 02 C9 02 5A
C0D8: D0 1A A9 FE 8D FA 07 A9 A5
C0E0: A1 8D 05 D0 A9 FD 2D A9 64
C0E8: 02 8D A9 02 A9 00 8D 04 5F
C0F0: D4 4C B2 C1 AE AA 02 E8 CA
C0F8: BD 08 CA 8D 05 D4 8D FA 79
C100: 07 8E AA 02 AD 05 D0 8D 53
C108: 00 D4 38 E9 0A 8D 05 D0 6C
C110: 60 AD A9 02 29 04 F0 36 1E
C118: AD A8 02 29 10 D0 2F A9 53
C120: FB 2D A9 02 09 08 8D A9 3D
C128: 02 A9 F7 2D 10 D0 8D 10 77
C130: D0 AD 04 D0 18 69 18 8D AA
C138: 06 D0 AD 05 D0 18 69 0A 1E
C140: 8D 07 D0 AD 15 D0 09 08 4A
```

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C148: 8D 15 D0 20 A5 C9 AD A9 A2
C150: 02 29 08 F0 5D AD AE 02 30
C158: 4A 18 69 FD 8D AB 02 AD 0B
C160: 07 D0 18 6D AB 02 8D 07 FF
C168: D0 8D 00 D4 AD 06 D0 18 38
C170: 69 06 8D 06 D0 8D 01 D4 A7
C178: 8D 05 D4 90 08 A9 08 0D 37
C180: 10 D0 8D 10 D0 AD 10 D0 5E
C188: 29 08 F0 25 A9 5A 38 CD D9
C190: 06 D0 B0 1D AD 15 D0 29 F1
C198: F7 8D 15 D0 A9 F7 2D 10 E2
C1A0: D0 8D 10 D0 A9 F7 2D A9 58
C1A8: 02 8D A9 02 A9 00 8D 04 1F
C1B0: D4 60 A9 FB 2D A9 02 8D F1
C1B8: A9 02 AD A8 02 C9 7D D0 D4
C1C0: 03 4C BA C2 48 A9 A1 8D AE
C1C8: 05 D0 68 C9 7E D0 03 4C 6F
C1D0: FD C1 C9 7B D0 03 4C 17 0D
C1D8: C2 C9 77 D0 03 4C 2C C2 EB
C1E0: C9 6B D0 03 4C 44 C2 C9 07
C1E8: 67 D0 03 4C 4C C2 C9 7A C3
C1F0: D0 03 4C 54 C2 C9 76 D0 39
C1F8: 03 4C 87 C2 60 AD A9 02 4C
C200: 29 08 F0 03 4C C5 C2 A9 A3
C208: FE 8D AC 02 A9 04 0D A9 A7
C210: 02 8D A9 02 4C C5 C2 AD CD
C218: 04 D0 C9 19 D0 03 4C C5 B5
C220: C2 CE 04 D0 A9 F5 8D AC 60
C228: 02 4C C5 C2 AD 04 D0 C9 4B
C230: 82 D0 06 20 FC C7 4C C5 80
C238: C2 A9 F5 8D AC 02 EE 04 C9
C240: D0 4C C5 C2 A9 F3 8D AC BD
C248: 02 4C C5 C2 A9 F1 8D AC F4
C250: 02 4C C5 C2 A9 01 2D A9 A8
C258: 02 D0 26 A9 01 0D A9 02 B4
C260: 8D A9 02 A9 03 8D AA 02 80
C268: A9 00 8D 04 D4 A9 4B 8D FA
C270: 00 D4 A9 12 8D 05 D4 A9 12
C278: E0 8D 06 D4 A9 81 8D 04 7E
C280: D4 A9 14 8D AF 02 60 A9 5C
C288: 02 2D A9 02 D0 26 A9 02 06
C290: 0D A9 02 8D A9 02 A9 FF 2C
C298: 8D AA 02 A9 00 8D 04 D4 E2
C2A0: A9 4B 8D 00 D4 A9 12 8D 41
C2A8: 05 D4 A9 E0 8D 06 D4 A9 1F
C2B0: 81 8D 04 D4 A9 14 8D AF 93
C2B8: 02 60 A9 F8 8D FA 07 A9 F6
C2C0: AB 8D 05 D0 60 CE AE 02 AF
C2C8: D0 33 A9 00 8D 04 D4 A9 86
C2D0: 0A 8D AE 02 A9 01 38 ED E9
C2D8: AD 02 8D AD 02 18 6D AC F7
C2E0: 02 8D FA 07 A9 05 8D 00 AE
C2E8: D4 A9 03 8D 01 D4 A9 60 D7
C2F0: 8D 05 D4 A9 00 8D 06 D4 6A
C2F8: A9 81 8D 04 D4 60 AD 00 98
C300: D0 38 E9 03 8D 00 D0 29 7D
C308: 05 8D 27 D0 B0 22 A9 01 10
C310: 2D 10 D0 D0 13 A9 01 0D B9
C318: 15 D0 8D 15 D0 20 97 E0 0A
C320: A5 8C 18 69 28 8D 01 D0 5B
C328: A9 01 4D 10 D0 8D 10 D0 6F
C330: AD 02 D0 38 E9 02 8D 02 64
C338: D0 B0 29 A9 02 2D 10 D0 9C
C340: D0 1A A9 02 0D 15 D0 8D 57
C348: 15 D0 20 97 E0 A5 8C 18 11
C350: 69 32 65 02 8D 03 D0 29 DD
C358: 01 8D 28 D0 A9 02 4D 10 E8
C360: D0 8D 10 D0 60 A9 10 2D E6
C368: 10 D0 D0 3F AD 00 D0 CD A5
C370: 08 D0 D0 12 A9 05 8D 07 6F
C378: D4 A9 D4 8D 0C D4 8D 0D D4
C380: D4 A9 81 8D 0B D4 AD 00 9B
C388: D0 38 ED B5 02 8D 00 D0 95
C390: 8D 08 D4 8D 0C D4 B0 13 2D
C398: AD 08 D0 8D 00 D0 A9 00 27
C3A0: 8D 0B D4 A9 01 0D 15 D0 AB
C3A8: 8D 15 D0 AD 00 D0 8D 27 4F
C3B0: D0 AD B7 02 30 39 CE B3 D4
C3B8: 02 D0 7D A6 02 A9 04 38 97
C3C0: C5 02 90 13 A9 01 38 ED FC
C3C8: B6 02 8D B6 02 BD 29 CA 79
C3D0: 18 6D B6 02 8D FC 07 BD 5E
C3D8: 0B CA 8D B3 02 AD 08 D0 78
C3E0: 38 E9 01 8D 08 D0 B0 50 6B
C3E8: A9 10 2D 10 D0 D0 41 A9 6C
C3F0: 00 8D B2 02 A9 EF 2D 15 0F
C3F8: D0 8D 15 D0 A9 FB 8D F8 69
C400: 07 A9 03 0D 10 D0 8D 10 3F
C408: D0 A9 FF 8D 00 D0 A9 01 8B
C410: 0D 1D D0 8D 1D D0 A9 00 30
C418: 8D 0B D4 A9 FE 2D 1C D0 48
C420: 8D 1C D0 20 C4 C9 B5 02 01
C428: 18 6D 0A D0 8D 0A D0 60 51
C430: A9 10 4D 10 D0 8D 10 D0 86
C438: 60 A2 17 A0 00 18 20 F0 1C
C440: FF A2 00 BD 0B CB 20 D2 6A
C448: FF E8 E0 21 D0 F5 A4 02 A0
C450: 10 02 A0 00 B9 C7 CB 85 D5
C458: FB B9 D1 CB 85 FC A0 00 CE
C460: B1 FB 20 D2 FF C8 C0 08 92
C468: D0 F6 A9 21 20 D2 FF 60 4E
C470: AD B1 02 C9 84 D0 03 4C 40
C478: 81 C5 C9 14 F0 4F C9 05 AC
C480: F0 76 C9 06 F0 7D C9 09 F8
C488: F0 09 C9 0A F0 10 C9 18 39
C490: F0 17 60 A9 FE 2D 15 D0 B4
C498: 8D 15 D0 4C 55 C5 A9 FD 1B
C4A0: 2D 15 D0 8D 15 D0 4C 55 C8
C4A8: C5 CE B7 02 A9 01 8D 2B 5A
C4B0: D0 A9 FE 85 A2 A5 A2 D0 6B
C4B8: FC A6 02 BD 15 CA 8D 2B B4
C4C0: D0 A9 F7 2D 15 D0 8D 15 E8
C4C8: D0 4C 55 C5 60 AD 08 D0 E7
C4D0: 18 69 0A 8D 08 D0 A9 01 6D
C4D8: 8D 2B D0 A9 FE 85 A2 A5 D8
C4E0: A2 D0 FC A6 02 BD 15 CA 97
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C4E8: 8D 2B D0 AD FA 07 C9 F1 DD
C4F0: D0 03 CE B7 02 4C 0E C5 6D
C4F8: A9 FE 2D 15 D0 8D 15 D0 28
C500: 4C 0E C5 A9 FD 2D 15 D0 DA
C508: 8D 15 D0 4C 0E C5 AD FA 44
C510: 07 C9 F1 F0 40 CE 0A D0 AD
C518: A2 05 A9 FB 2D 1C D0 8D 0D
C520: 1C D0 A9 01 8D 29 D0 A9 E8
C528: FE 85 A2 A5 A2 D0 FC A9 0F
C530: 00 8D 29 D0 A9 FE 85 A2 88
C538: A5 A2 D0 FC CA D0 E3 A9 77
C540: 04 0D 1C D0 8D 1C D0 AD 66
C548: 04 D0 38 E9 0A 38 C9 5A A5
C550: 90 03 8D 04 D0 A9 00 8D 7D
C558: 04 D4 A9 0A 8D 01 D4 A9 F1
C560: 05 8D 00 D4 A9 60 8D 05 64
C568: D4 A9 60 8D 06 D4 A9 81 DA
C570: 8D 04 D4 A0 FB 84 A2 A4 3F
C578: A2 D0 FC A9 00 8D 04 D4 F8
C580: 60 20 6D C9 AD 0E D0 8D 52
C588: 04 D0 A9 F9 8D FA 07 A2 33
C590: 4B AC 05 D0 C8 8C 05 D0 89
C598: 20 CF C5 CA D0 F3 AD 10 9B
C5A0: D0 09 80 8D 10 D0 A9 00 13
C5A8: 8D 04 D4 AD 0A D0 38 E9 B9
C5B0: 0A 8D 0A D0 A9 A1 8D 05 01
C5B8: D0 A9 F7 8D FA 07 A9 64 C8
C5C0: 8D 04 D0 20 C4 C9 AD 11 90
C5C8: D0 10 FB AD 1E D0 60 A9 4C
C5D0: 0F 8D 18 D4 8D 00 D4 A9 66
C5D8: 60 8D 05 D4 A9 F0 8D 06 CE
C5E0: D4 A9 11 8D 04 D4 8E 01 66
C5E8: D4 8A 48 8E 01 D4 A0 FF 95
C5F0: 88 D0 FD CA D0 F5 68 AA EC
C5F8: 60 A9 00 8D 20 D0 8D 21 30
C600: D0 20 7D C9 A9 90 20 D2 65
C608: FF A9 93 20 D2 FF A9 09 EA
C610: 8D 21 D0 A0 00 8C 2D D0 BA
C618: A9 12 20 D2 FF A2 02 A0 0C
C620: 00 18 20 F0 FF A2 F0 A9 86
C628: DB 20 D2 FF CA D0 F8 A2 2E
C630: 08 A0 01 18 20 F0 FF 20 23
C638: 0B C7 A2 08 A0 0C 18 20 9A
C640: F0 FF 20 0B C7 A2 08 A0 6F
C648: 17 18 20 F0 FF 20 0B C7 7B
C650: A2 08 A0 21 18 20 F0 FF E5
C658: 20 0B C7 20 7C C7 20 92 62
C660: C7 20 E1 C7 A9 F7 8D FA 1C
C668: 07 A9 FC 8D FB 07 A9 E5 36
C670: 8D 15 D0 8D 1D D0 A9 B4 BD
C678: 8D 17 D0 A9 0E 8D 25 D0 29
C680: A9 01 8D 26 D0 8D 2A D0 38
C688: 8D 27 D0 A9 00 8D 29 D0 3F
C690: A9 0D 8D 28 D0 A9 FB 8D 01
C698: F8 07 A9 F0 8D FE 07 A9 70
C6A0: 96 8D 0C D0 A9 E1 8D 0D C7
C6A8: D0 A9 FC 8D F9 07 A9 C3 1C
C6B0: 8D 0A D0 A9 E0 8D 0B D0 0D
C6B8: A9 0D 8D FD 07 A9 78 8D B1
C6C0: 04 D0 A9 14 8D 1C D0 A9 77
C6C8: A1 8D 05 D0 A9 CA 8D 0F DE
C6D0: D0 A9 09 8D 2E D0 8D 2C 9A
C6D8: D0 A2 3F A9 00 9D 3C 03 12
C6E0: CA 10 FA A2 1B A9 FF 9D BB
C6E8: 3C 03 CA 10 FA A9 0D 8D 42
C6F0: FF 07 A2 14 A9 00 9D A7 9D
C6F8: 02 CA 10 FA A9 0A 8D AE C0
C700: 02 A9 FF 85 02 A9 93 8D FD
C708: 10 D0 60 A9 CA 20 D2 FF B0
C710: A9 C3 20 D2 FF A9 C3 20 FD
C718: D2 FF A9 CB 20 D2 FF A9 FC
C720: 9D 20 D2 FF A9 9D 20 D2 EA
C728: FF A9 9D 20 D2 FF A9 11 1D
C730: 20 D2 FF A2 09 A9 C2 20 5B
C738: D2 FF A9 C2 20 D2 FF A9 14
C740: 9D 20 D2 FF A9 9D 20 D2 0B
C748: FF A9 11 20 D2 FF CA D0 91
C750: E4 A9 9D 20 D2 FF A9 D5 EE
C758: 20 D2 FF A9 C3 20 D2 FF AB
C760: A9 C3 20 D2 FF A9 C9 20 54
C768: D2 FF A2 13 A0 00 18 20 C9
C770: F0 FF A2 50 A9 DB 20 D2 CC
C778: FF CA D0 F8 A2 0A A0 05 5F
C780: 18 20 F0 FF A2 00 BD 2C 36
C788: CB 20 D2 FF E8 E0 35 D0 17
C790: F5 60 A9 92 20 D2 FF A2 B8
C798: 09 A0 11 18 20 F0 FF A2 1F
C7A0: 05 A9 5E 20 D2 FF CA D0 3C
C7A8: F8 A9 12 20 D2 FF A2 0A FC
C7B0: A0 10 18 20 F0 FF A2 07 34
C7B8: A9 DA 20 D2 FF CA D0 F8 C4
C7C0: A2 0B 8A 48 A9 92 20 D2 70
C7C8: FF A0 11 18 20 F0 FF A2 46
C7D0: 05 A9 C2 20 D2 FF CA D0 D0
C7D8: F8 68 AA E8 E0 11 D0 E2 73
C7E0: 60 A9 12 20 D2 FF A2 0C 9E
C7E8: A0 1C 18 20 F0 FF A2 00 71
C7F0: BD 61 CB 20 D2 FF E8 E0 98
C7F8: 16 D0 F5 60 38 AD 0E D0 FA
C800: E9 01 8D 0E D0 B0 18 AD CD
C808: 10 D0 49 80 8D 10 D0 A9 CA
C810: 80 0D 15 D0 8D 15 D0 AD A4
C818: B2 02 F0 03 20 AB C3 AE FE
C820: A7 02 F0 3D CA 8E A7 02 FA
C828: AD 16 D0 29 F8 0D A7 02 95
C830: 8D 16 D0 4C 61 C8 AD A7 70
C838: 02 D0 23 38 AD 0E D0 E9 DC
C840: 01 8D 0E D0 B0 08 AD 10 24
C848: D0 49 80 8D 10 D0 A9 07 02
C850: 8D A7 02 29 F8 0D A7 02 60
C858: 8D 16 D0 20 62 C8 A9 E1 A3
C860: 60 60 AD 11 D0 29 BF 8D 27
C868: 11 D0 A9 40 85 FB A9 05 64
C870: 85 FC A2 0B A0 00 C8 B1 BB
C878: FB 88 91 FB C8 C0 27 D0 0C
C880: F5 A0 00 B1 FB A0 27 91 1E
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C888: FB 18 A5 FB 69 28 85 FB 51
C890: A5 FC 69 00 85 FC A0 00 BF
C898: CA D0 DB CE B4 02 F0 01 87
C8A0: 60 A9 FF 8D B4 02 E6 02 D7
C8A8: C9 0B D0 01 60 A6 02 8A E2
C8B0: 18 0A 0A 8E B7 02 BD 0B ED
C8B8: CA 8D B3 02 BD 29 CA 8D 06
C8C0: FC 07 BD 15 CA 8D 2B D0 EB
C8C8: 8D 20 D0 A9 10 0D 10 D0 EE
C8D0: 8D 10 D0 A9 FE 2D 1D D0 03
C8D8: 8D 1D D0 A9 50 8D 08 D0 B4
C8E0: A9 9F 8D 09 D0 8D 01 D0 F0
C8E8: A9 FC 2D 15 D0 8D 15 D0 16
C8F0: BD 1F CA 8D F8 07 A9 FF CF
C8F8: 8D 00 D0 AD 1D D0 1D 33 43
C900: CA 8D 1D D0 AD 1C D0 1D FD
C908: 3D CA 8D 1C D0 A9 FC 2D 5E
C910: 10 D0 8D 10 D0 A9 01 8D 97
C918: B2 02 A9 10 0D 1D D0 8D 0F
C920: 1D D0 A9 10 0D 15 D0 8D 48
C928: 15 D0 A5 02 4A 8D B5 02 45
C930: EE B5 02 60 78 A9 53 8D 3A
C938: 14 03 A9 C9 8D 15 03 A9 12
C940: E1 8D 12 D0 AD 11 D0 29 4B
C948: 7F 8D 11 D0 A9 81 8D 1A 0A
C950: D0 58 60 AD 19 D0 8D 19 18
C958: D0 29 01 D0 07 AD 0D DC C2
C960: 58 4C 31 EA 20 36 C8 8D CD
C968: 12 D0 4C BC FE A2 18 A9 B7
C970: 00 9D 00 D4 CA 10 FA A9 62
C978: 0F 8D 18 D4 60 A2 00 8E 93
C980: 15 D0 20 6D C9 BD 47 CA 8D
C988: 20 D2 FF E8 E0 C4 D0 F5 D0
C990: 20 39 C4 AD 00 DC C9 6F 72
C998: D0 F9 A9 8E 20 D2 FF A9 38
C9A0: 08 20 D2 FF 60 A9 1E 8D 51
C9A8: 01 D4 A9 4B 8D 00 D4 A9 7F
C9B0: E0 8D 05 D4 A9 40 8D 06 76
C9B8: D4 A9 00 8D 04 D4 A9 81 C8
C9C0: 8D 04 D4 60 A9 00 8D 12 D0
C9C8: D4 A9 0F 8D 18 D4 A9 00 7A
C9D0: 8D 0F D4 A9 00 8D 0E D4 5C
C9D8: A9 09 8D 13 D4 A9 00 8D 38
C9E0: 14 D4 A9 11 8D 12 D4 A2 9B
C9E8: C8 8E 0E D4 8A 6A 8D 0F B4
C9F0: D4 A9 FF 85 A2 A5 A2 D0 B0
C9F8: FC CA 8E 14 D4 D0 EA 60 54
CA00: 01 02 04 08 10 20 40 80 FF
CA08: F8 F9 FA 07 07 06 06 05 15
CA10: 05 04 04 03 03 08 0B 0C 42
CA18: 06 03 02 06 04 00 00 FC 2A
CA20: FC FC FC FD FD FD FB FB 09
CA28: FB F5 F3 F3 F3 F3 FD FD E5
CA30: FD FD F3 00 00 00 01 00 21
CA38: 00 00 01 01 01 00 01 00 3C
CA40: 00 00 01 01 00 01 01 0E 52
CA48: 08 93 11 11 11 11 1D 1D 62
CA50: 1D 1D 1D 1D 1D 1D 12 97 A8
CA58: 20 20 20 20 20 20 20 20 59
CA60: 20 20 20 20 20 20 20 20 61
CA68: 20 20 20 20 20 20 0D 12 48
CA70: 1D 1D 1D 1D 1D 1D 1D 1D 59
CA78: 97 20 1F 20 20 20 D4 48 CC
CA80: 45 20 CC 41 53 54 20 CE 8A
CA88: 49 4E 4A 41 20 20 20 97 A3
CA90: 20 0D 12 1D 1D 1D 1D 1D 61
CA98: 1D 1D 1D 97 20 20 20 20 08
CAA0: 20 20 20 20 20 20 20 20 A1
CAA8: 20 20 20 20 20 20 20 20 A9
CAB0: 20 20 11 11 11 11 11 11 57
CAB8: 9A 0D 12 20 20 20 20 20 13
CAC0: 20 20 20 CA 4F 59 53 54 3C
CAC8: 49 43 4B 20 49 4E 20 50 C8
CAD0: 4F 52 54 20 54 57 4F 20 02
CAD8: 20 20 20 20 20 20 20 20 D9
CAE0: 20 20 20 20 D0 52 45 53 1D
CAE8: 53 20 4A 4F 59 53 54 49 40
CAF0: 43 4B 20 42 55 54 54 4F 2F
CAF8: 4E 20 54 4F 20 53 54 41 14
CB00: 52 54 20 47 41 4D 45 20 02
CB08: 20 20 20 12 1C 20 D9 4F DF
CB10: 55 20 48 41 56 45 20 41 0C
CB18: 54 54 41 49 4E 45 44 20 43
CB20: 54 48 45 20 52 41 4E 4B 4F
CB28: 20 4F 46 20 12 B0 C3 C3 48
CB30: C3 C3 C3 AE 11 9D 9D 9D 14
CB38: 9D 9D 9D 9D C2 2E CE CD 3C
CB40: 2E D7 C2 11 9D 9D 9D 9D 90
CB48: 9D 9D 9D C2 CE 20 20 CD C0
CB50: CE C2 11 9D 9D 9D 9D 9D 07
CB58: 9D 9D AD C3 C3 C3 C3 C3 14
CB60: BD D5 C3 C3 C9 11 9D 9D 91
CB68: 9D 9D C2 A6 A6 C2 11 9D 25
CB70: 9D 9D 9D CA C3 C3 CB C1 29
CB78: 44 45 50 54 20 20 20 D3 DA
CB80: 48 55 47 59 4F 20 20 D9 28
CB88: 55 44 41 4E 53 48 41 D4 63
CB90: 49 47 45 52 20 20 20 C4 DD
CB98: 52 41 47 4F 4E 20 20 CE 20
CBA0: 49 4E 4A 41 20 20 20 D3 F7
CBA8: 48 49 4E 4F 42 49 20 D3 57
CBB0: 45 4E 53 45 49 20 20 D3 3A
CBB8: 48 49 44 4F 53 48 49 CA 8D
CBC0: 4F 4E 49 4E 20 20 20 77 CD
CBC8: 7F 87 8F 97 9F A7 AF B7 A5
CBD0: BF CB CB CB CB CB CB CB 23
CBD8: CB CB CB A9 00 85 FB A9 11
CBE0: CC 85 FC A9 00 85 FD A9 07
CBE8: 3C 85 FE A2 04 A0 FF B1 A2
CBF0: FB 91 FD 88 C0 FF D0 F7 8E
CBF8: E6 FC E6 FE CA 10 EE 60 EC
CC00: 00 7F 00 01 E0 C0 07 C0 E9
CC08: 30 0F 8C 18 0F 9E 0C 1F C4
CC10: 9E 04 1F 8C 04 1F E0 04 66
CC18: 1F FE 04 1F FF 04 0F E7 54
CC20: 8C 0F C3 98 07 C3 B0 01 94
```

```
CC28: E7 C0 00 7F 00 00 00 00 50
CC30: 07 B6 F0 07 B6 60 06 3E 41
CC38: 60 07 B6 60 07 B6 F0 00 65
CC40: 05 54 00 01 68 00 00 54 57
CC48: 00 00 54 03 00 50 03 01 F3
CC50: FC 03 01 FE 03 01 BE 83 96
CC58: 01 AA A3 01 A8 A9 00 A8 A3
CC60: 2B 00 54 03 00 A4 00 00 87
CC68: AA 00 00 A2 80 00 A0 80 57
CC70: 00 A0 80 00 A0 80 02 80 35
CC78: 80 01 40 50 01 50 54 00 30
CC80: 05 54 0C 01 68 0C 00 54 AF
CC88: 0C 00 54 0C 00 50 0C 01 52
CC90: FE 0C 01 FE A4 01 BE AC AC
CC98: 01 A8 8C 01 A8 00 00 A8 21
CCA0: 00 00 54 00 00 A4 00 00 99
CCA8: AA 00 00 A2 80 00 A0 80 97
CCB0: 00 A0 80 00 A0 80 02 80 75
CCB8: 80 01 40 50 01 50 54 00 70
CCC0: C0 55 40 C0 A5 00 C0 54 92
CCC8: 00 C0 54 00 C0 14 00 C0 73
CCD0: FD 00 42 FD 00 EA BD 00 B7
CCD8: EA A9 00 20 A9 00 00 A8 DF
CCE0: 00 00 54 00 00 68 00 00 9D
CCE8: A8 00 02 A8 00 02 8A 00 C8
CCF0: 02 8A 00 02 8A 00 02 8A 96
CCF8: 00 01 45 00 05 55 00 00 99
CD00: 30 55 40 30 A5 00 30 54 20
CD08: 00 30 54 00 30 14 00 30 01
CD10: FD 00 12 FD 00 3A BD 00 16
CD18: 3A A9 00 08 A9 00 08 A8 5E
CD20: 00 00 54 00 00 68 00 00 DC
CD28: A8 00 00 A8 00 02 8A 00 06
CD30: 02 8A 00 0A 02 80 0A 02 55
CD38: 80 14 01 40 54 05 40 00 A7
CD40: 05 55 40 01 A9 00 40 54 1A
CD48: 00 50 54 00 80 FC 00 81 EB
CD50: FD A0 89 A9 A0 A8 A8 A0 B4
CD58: A0 A8 A0 00 A8 20 00 A8 B3
CD60: 20 00 57 50 02 AB D0 02 A8
CD68: A8 30 02 A8 0C 02 08 03 05
CD70: 02 08 00 02 08 00 01 08 8D
CD78: 00 05 04 00 00 05 00 00 86
CD80: 05 55 40 01 A9 00 00 54 1A
CD88: 00 00 54 20 00 FC A0 01 9B
CD90: FD A0 09 A9 A0 2A A8 20 75
CD98: A0 A8 20 A0 A8 20 80 AB 97
CDA0: 50 90 57 D0 40 A8 30 40 03
CDA8: AA 0C 00 AA 03 00 82 00 8F
CDB0: 00 82 00 00 81 00 00 81 36
CDB8: 40 00 40 00 01 40 00 00 7A
CDC0: 00 00 00 0F FF 00 30 00 FF
CDC8: C0 C0 00 30 C0 00 30 C5 31
CDD0: 54 30 C1 68 C0 30 54 00 C4
CDD8: 0C 54 40 00 50 50 01 BC D7
CDE0: 90 01 FE A0 01 EA 80 03 81
CDE8: AA 00 0D A8 00 30 A8 00 22
CDF0: C0 50 00 00 A0 00 10 A8 5B
CDF8: 00 1A AA 00 5A AA 00 16 D8
CE00: 00 00 00 00 00 00 00 00 00
CE08: 00 00 00 00 00 00 00 00 08
CE10: 00 00 00 00 30 02 40 C0 43
CE18: 0A 67 41 0A 6E 41 0A 7A 09
CE20: 85 0A EA D5 0A 2A D9 0A 88
CE28: 2A D9 0A 28 D9 68 28 00 C8
CE30: 58 28 00 50 28 00 40 0A 73
CE38: 00 40 05 00 00 01 40 00 BE
CE40: 15 00 00 05 00 00 0A 00 64
CE48: 00 0A 00 00 0A A8 00 02 07
CE50: AA 00 00 15 03 00 2A 0C 49
CE58: 00 2A 70 12 2A C0 16 BF C5
CE60: 40 06 BF 40 00 BE 40 00 A5
CE68: 05 00 00 15 00 00 15 00 97
CE70: 00 29 40 00 15 50 00 00 3F
CE78: 00 00 00 00 00 00 00 00 78
CE80: 01 40 00 00 50 01 00 A0 B3
CE88: 01 00 28 05 00 28 25 00 04
CE90: 28 29 67 28 A0 67 A8 A0 C2
CE98: 67 A8 A0 57 AB A0 51 AD EB
CEA0: A0 41 79 A0 41 D9 A0 03 5B
CEA8: 01 80 0C 00 00 00 00 00 36
CEB0: 00 00 00 00 00 00 00 00 B0
CEB8: 00 00 00 00 00 00 00 20 D8
CEC0: 00 00 00 00 00 00 02 80 43
CEC8: 00 09 30 00 34 48 00 7B F9
CED0: E5 00 CD 12 A0 CC A5 00 A9
CED8: 79 50 00 37 E4 00 08 10 D6
CEE0: 00 02 A0 00 00 00 00 00 83
CEE8: 00 00 00 00 00 00 00 00 E8
CEF0: 00 00 00 00 00 00 00 00 F0
CEF8: 00 00 00 00 00 00 00 7C 75
CF00: 00 00 00 00 00 00 00 00 00
CF08: 00 00 00 00 00 18 00 00 20
CF10: 30 00 00 30 00 00 78 00 E8
CF18: 08 FC 00 0F CF 80 07 CF 53
CF20: C0 00 FC 40 00 78 00 00 96
CF28: 30 00 00 30 00 00 60 00 E8
CF30: 00 00 00 00 00 00 00 00 30
CF38: 00 00 00 00 00 00 00 20 58
CF40: 02 6A 02 0A A8 82 08 E8 D4
CF48: 09 3F A8 26 CA A0 9A 00 65
CF50: 82 6A 01 89 AA 02 AB FA 1B
CF58: 01 AC 2E 0A B0 23 06 B0 C8
CF60: 23 0A C0 00 06 C0 08 0A 27
CF68: C0 22 06 C0 02 0A C0 02 E0
CF70: 01 C0 02 02 B0 0E 00 6F 64
CF78: F8 00 2A A8 00 00 00 20 64
CF80: 00 00 00 00 00 00 00 00 80
CF88: 00 05 54 00 01 68 00 00 4B
CF90: 54 00 00 54 00 00 50 00 89
CF98: 01 BE 01 01 FE A5 01 EA EA
CFA0: A4 03 AA 00 0D AA 94 30 6F
CFA8: A8 90 C0 54 00 00 AA 80 22
CFB0: 00 AA A0 00 A0 A0 06 A0 E3
CFB8: A0 16 A0 50 14 00 54 00 C8
CFC0: 00 00 00 00 00 00 00 00 C0
```

IMPORTANT! Letters on white background are **Bug Repellent** line codes. **Do not enter them!** Pages 87-89 explain these codes and provide other essential information on entering *Ahoy!* programs. Refer to these pages **before** entering any programs!

```
CFC8: 00 05 54 14 01 68 04 00 A3
CFD0: 54 08 00 54 28 00 50 A8 A2
CFD8: 01 BE A0 01 FE 80 01 EA A5
CFE0: A5 03 AA A4 0D AA 00 30 C0
CFE8: A8 00 C0 54 00 00 AA 80 D1
CFF0: 00 AA A0 00 A0 A0 06 A0 24
CFF8: A8 06 A0 14 05 00 15 00 76
```

MULTI RAM
FROM PAGE 45

```
·10 REM *** MULTI RAM *** BUCK CHILDRESS
(06/14/86) ***                                MO
·20 REM *** P.O. BOX 13575 SALEM, OR 9730
9 ***                                         DC
·30 PRINTCHR$(147)"LOADING AND CHECKING D
ATA LINE:":J=53000:L=110:C=11                 GI
·40 PRINTCHR$(19)TAB(31)L:PRINT:FORB=0TOC
:READA:IFA<0ORA>255THEN60                     KG
·50 POKEJ+B,A:X=X+A:NEXTB:READA:IFA=XTHEN
70                                            BP
·60 PRINT"ERROR IN DATA LINE:"L:END           HL
·70 X=0:J=J+12:L=L+10:IFL<280THEN40           AM
·80 IFL=280THENC=13:GOTO40                    FD
·90 PRINT"THE DATA IS OK AND LOADED[3"."]
":PRINT                                       GI
·100 PRINT"MULTI RAM IS NOW ACTIVE[3"."]"
:SYS 53000:NEW                                NA
·110 DATA173,143,2,174,144,2,224,207,240,
16,141,240,1706                               AO
·120 DATA207,142,241,207,169,35,162,207,1
41,143,2,142,1798                             HH
·130 DATA144,2,96,173,141,2,201,4,208,17,
165,203,1356                                  KJ
·140 DATA205,197,207,240,10,141,197,207,2
01,1,208,6,1820                               IP
·150 DATA76,156,207,108,240,207,201,3,144
,249,201,7,1799                               EI
·160 DATA176,245,172,199,207,141,199,207,
165,45,192,5,1953                             FE
·170 DATA176,17,166,46,141,204,207,141,20
5,207,142,208,1860                            MA
·180 DATA207,142,209,207,76,107,207,153,2
01,207,165,46,1927                            AK
·190 DATA153,205,207,172,197,207,185,197,
207,133,44,185,2092                           IF
·200 DATA201,207,133,45,133,47,133,49,185
,205,207,133,1678                             AM
·210 DATA46,133,48,133,50,185,209,207,133
,56,169,0,1369                                GG
·220 DATA170,133,43,129,43,133,55,232,134
,43,173,197,1485                              HJ
·230 DATA207,141,198,207,162,19,160,0,189
,197,207,240,1927                             DI
·240 DATA8,32,187,207,232,200,76,160,207,
136,136,173,1754                              FB
·250 DATA198,207,24,105,173,32,187,207,10
8,240,207,153,1841                            OB
·260 DATA0,4,173,134,2,153,0,216,96,128,3
,4,913                                        AB
·270 DATA8,8,84,192,3,3,3,3,8,8,84,192,59
6                                             GF
·280 DATA160,84,160,207,160,146,129,141,1
60,189,160,160,160,0,2016                     JD
```

TRAPPED
FROM PAGE 56

```
·10 DIMC(14),L(10,7,7),B(7,7):PRINTCHR$(1
42)CHR$(8):GOTO5000                           CI
·70 XP=INT(RND(1)*7)+1:YP=INT(RND(1)*7)+1
:IFB(XP,YP)=0THEN70                           OF
·80 POKEV+21,2:GOSUB840:X=XP*32+11:Y=YP*2
4+36:POKEV,X:POKEV+1,Y:POKEV+21,3:TU=1        MP
·100 IF((YP<1ORYP>7)OR(XP<1ORXP>7))ORXA=X
PANDYA=YPTHEN900                              KD
·101 IFB(XP,YP)=5OR(B(XP,YP)=2ANDTU=1)THE
N180                                          HI
·102 IFB(XP,YP)=0THEN900                      KC
·103 IFB(XP,YP)=2THEN70                       IH
·104 IFB(XP,YP)=1ANDN=2THENB(XP,YP)=4:GOT
O118                                          EI
·105 IFB(XP,YP)=1ORB(XP,YP)=4THENB(XP,YP)
=5:GOTO107                                    AD
·106 GOTO118                                  CK
·107 PRINT"[HOME]";:POKE214,YP*3-2:PRINT:
POKE211,XP*3+XP-2                             CJ
·110 PRINTMID$("[c 3][RED][c 1][YELLOW][c
 6][GREEN][CYAN][c 7][BLUE][c 7]",LV,1)"
[s N][c Y][s M][DOWN][3"[LEFT]"][s M][c
P][s N]":POKE2040,14                          PN
·112 BT=BT+1:IFBT=TTHEN400                    FB
·114 SC=SC+2*LV:IFSC>HSTHENHS=SC              IM
·116 PRINT"[HOME][DOWN][DOWN][RED]"TAB(31
)"SCORE[DOWN][5"[LEFT]"]"SC:PRINT"[c 1][
DOWN][DOWN]"TAB(31)"HIGH[DOWN][4"[LEFT]"
]"HS                                          IK
·117 IFB=1THENB=0:GOTO120                     PN
·118 GOTO180                                  CN
·120 IFPEEK(653)=1THEN120                     GJ
·128 J=PEEK(56320)AND15:IFJ=14THENPOKE204
0,14:SYS49168:YP=YP-1:GOSUB800:GOTO100        CC
·130 IFJ=13THENPOKE2040,14:SYS49182:YP=YP
+1:GOSUB800:GOTO100                           DF
·140 IFJ=11THENPOKE2040,14:SYS49196:XP=XP
-1:GOSUB800:GOTO100                           JP
·150 IFJ=7THENPOKE2040,14:SYS49210:XP=XP+
1:GOSUB800:GOTO100                            GN
·180 IFINT(RND(1)*5)>2THEN300                 CB
·190 D=5:ONINT(RND(1)*2)+1GOTO200,230         DP
·200 IFXA>XPTHENXA=XA-1:D=1:IFB(XA,YA)=6T
HENXA=XA+1:D=5                                KB
```

```
·210 IFXA<XPTHENXA=XA+1:D=2:IFB(XA,YA)=6T
 HENXA=XA-1:D=5                                DO
·220 GOTO250                                   CD
·230 IFYA<YPTHENYA=YA+1:D=3:IFB(XA,YA)=6T
 HENYA=YA-1:D=5                                LB
·240 IFYA>YPTHENYA=YA-1:D=4:IFB(XA,YA)=6T
 HENYA=YA+1:D=5                                AO
·250 ONDGOTO260,270,280,290,300                BF
·260 SYS49252:GOTO300                          BH
·270 SYS49266:GOTO300                          AM
·280 SYS49238:GOTO300                          PL
·290 SYS49224                                  KN
·300 POKEV+40,RND(1)*15+1:IFXP=XAANDYP=YA
 THEN900                                       CC
·310 GOTO120                                   CD
·400 POKES+5,0:POKES+6,240                     OE
·410 FORI=1TO30:POKE53281,I:POKES,RND(1)*
 255:POKES+1,RND(1)*255                        EO
·420 POKES+4,17:FORJ=1TORND(1)*25:NEXT:PO
 KES+4,16                                      NF
·430 NEXT:POKE53281,0                          MA
·480 POKEV+21,0:L=L+1:IFL>20THENL=20           PP
·490 N=1:IFL>10THENN=2                         EH
·500 LV=L:IFL>10THENLV=L-10                    BC
·510 FORI=1TO2000:NEXT:T=0:GOTO1000            JL
·800 POKES+5,5:POKES+6,53:POKES+1,25:POKE
 S+12,5:POKES+13,53                            IL
·810 POKES+7,30:POKES+8,30:POKES+4,129:PO
 KES+11,128                                    LK
·820 POKES+4,33:FORI=1TO50STEP10:POKES+1,
 I:FORJ=1TO5:NEXT:NEXT:POKES+4,32              DL
·830 POKE2040,13:RETURN                        NP
·840 POKES+5,15:POKES+6,0:POKES,67:POKES+
 4,17:FORI=1TO40:FORJ=0TO255STEPI+5            HJ
·850 POKES+1,J:NEXT:NEXT:POKES+4,16:RETUR
 N                                             FH
·900 FORI=1TO100:NEXT                          JG
·905 POKES+5,0:POKES+6,28:POKES,1:POKES+1
 ,2:POKES+4,129:POKES+4,128                    CN
·910 FORI=1TO180:POKEV+39,RND(1)*16+1:NEX
 T                                             NC
·920 B=1:SH=SH-1:PRINT"[HOME][21"[DOWN]"]
 [YELLOW]"TAB(31)SH:POKEV+21,0                 CA
·930 IFSH>0THEN980                             FB
·940 PRINT"[HOME][c 5][11"[DOWN]"]"TAB(10
 )"[RVSON][11" "]"                             FA
·950 PRINTTAB(10)"[RVSON] GAME OVER ":PRI
 NTTAB(10)"[RVSON][11" "]"                     GN
·960 FORI=1TO3000:NEXT:GOTO5480                HA
·980 GOTO1100                                  FL
·1000 POKE53281,0:PRINT"[CLEAR][DOWN]"         NE
·1010 POKE53280,12:FORI=1TO7:PRINT"  ";:F
 ORJ=1TO7:B(J,I)=L(LV,J,I)                     NK
·1020 IFB(J,I)=0THENA$="[4" "]"                CA
·1030 IFB(J,I)=1THENA$="[RVSON][sEP] [c *
 ][RVSOFF][DOWN][3"[LEFT]"][c *][RVSON] [
 RVSOFF][sEP][UP] "                            KI
·1040 IFB(J,I)=2THENA$="[WHITE][RVSON][3"
 "][DOWN][3"[LEFT]"][3" "][RVSOFF][UP] "       NJ
·1050 PRINTMID$("[c 3][RED][c 1][YELLOW][
 c 6][GREEN][CYAN][c 7][BLUE][c 7]",LV,1)
 A$;:NEXT:PRINT:PRINT:PRINT:NEXT               IH
·1060 PRINT"[RED][HOME][DOWN][DOWN]"TAB(3
 1)"SCORE[DOWN][5"[LEFT]"]"SC                  NP
·1070 PRINT"[c 1][DOWN][DOWN]"TAB(31)"HIG
 H[DOWN][4"[LEFT]"]"HS                         GG
·1080 PRINT"[c 3][5"[DOWN]"]"TAB(31)"LEVE
 L[DOWN][5"[LEFT]"]"L                          CN
·1090 PRINT"[YELLOW][5"[DOWN]"]"TAB(31)"S
 HIELDS[DOWN][7"[LEFT]"]"SH                    LM
·1100 XP=INT(RND(1)*7)+1:YP=INT(RND(1)*7)
 +1:IFB(XP,YP)=0ORB(XP,YP)=2THEN1100           MJ
·1110 XA=INT(RND(1)*7)+1:YA=INT(RND(1)*7)
 +1:IFB(XA,YA)=0ORB(XA,YA)=2THEN1110           PG
·1120 IFXP=XAANDYP=YATHEN1110                  MI
·1130 X=XP*32+11:Y=YP*24+36:A=XA*32+11:B=
 YA*24+39:POKEV+39,11                          BD
·1140 POKEV+23,0:POKEV+29,0:POKEV+21,3:PO
 KEV,X:POKEV+1,Y:POKEV+2,A:POKEV+3,B           IB
·1145 IFT<>0THEN1170                           PN
·1150 BT=0:T=0:TU=0:FORI=1TO7:FORJ=1TO7:I
 FB(J,I)=1THENT=T+1                            OB
·1160 NEXT:NEXT:B=1                            KG
·1170 POKES+5,16:POKES+6,9                     PB
·1180 FORI=3TO1STEP-1:PRINT"[HOME]"TAB(14
 )"[WHITE]"I                                   AG
·1190 POKES,I:POKES+1,I*10:POKES+4,17:FOR
 J=1TO20:NEXT:POKES+4,16                       IC
·1200 FORJ=1TO900:NEXT:NEXT                    GE
·1210 PRINT"[HOME]"TAB(15)" "                  JF
·1220 GOTO100                                  CF
·5000 PRINT"[CLEAR][c 1]";:POKE53280,0:V=
 53248:POKEV+21,0:POKE53281,0:C=9              JK
·5002 FORI=49152TO49279:READJ:POKEI,J:NEX
 T                                             GO
·5004 FORI=832TO1022:READJ:POKEI,J:NEXT:P
 OKE2040,13:POKE2041,15:SC=0:HS=0:L=1          CI
·5006 FORI=1TO10:FORJ=1TO7:FORK=1TO7:READ
 A:L(I,K,J)=A:NEXT:NEXT:NEXT:PRINT"[CLEAR
 ]"                                            JJ
·5010 POKEV+39,11:POKEV+40,2:S=54272:FORI
 =STOS+23:POKEI,0:NEXT:POKES+24,15             PK
·5020 L$(1)="[RVSON][3" "][DOWN][LEFT][LE
 FT] [DOWN][LEFT] [RVSOFF]":L$(3)="[RVSON
 ] [c O] [DOWN][3"[LEFT]"] [c U] [DOWN][3
 "[LEFT]"] [RIGHT] [RVSOFF]":L$(4)="[RVSO
 N] [c O] [DOWN][3"[LEFT]"] [c U] [DOWN][
 3"[LEFT]"] [RVSOFF]"                          HL
·5030 L$(5)="[RVSON][3" "][DOWN][3"[LEFT]
 "] [RVSOFF][s *][RVSON][DOWN][LEFT][LEFT
 ][3" "][RVSOFF]":L$(6)="[RVSON]  [c *][D
 OWN][3"[LEFT]"] [RIGHT] [DOWN][3"[LEFT]"
 ]  [RVSOFF][sEP][RVSOFF]"                     LD
·5040 L$(2)="[RVSON] [c O] [DOWN][3"[LEFT
 ]"] [c U][c O][DOWN][3"[LEFT]"] [RIGHT]
 [RVSOFF]"                                     EA
```

```
·5480 POKEV+21,0:POKE53280,0:POKE53281,9:
 PRINT"[CLEAR]":POKES+4,0:SH=4:CL=0:CO=0  AL
·5482 POKE646,CL:PRINT"[HOME][DOWN][5"[RI
 GHT]"]"L$(1)"[UP][UP][RIGHT][RIGHT]"L$(2
 )"[UP][UP][RIGHT]"L$(3)"[UP][UP][RIGHT]"
 L$(4)"[UP][UP][3"[RIGHT]"]"L$(4);         JO
·5484 PRINT"[UP][UP][3"[RIGHT]"]"L$(5)"[U
 P][UP][RIGHT]"L$(6)                       BD
·5490 PRINTTAB(4)"[5"[DOWN]"][YELLOW]SCOR
 E:"SCTAB(22)"HIGH SCORE:"HS               FC
·5500 PRINT"[DOWN][DOWN]"TAB(14)"LEVEL:"L
 :PRINT"[DOWN]"TAB(13)"SHIELDS:"SH         OP
·5510 PRINT"[3"[DOWN]"] PRESS [WHITE][RVS
 ON] F1 [RVSOFF][YELLOW] TO SELECT DIFFIC
 ULTY LEVEL"                               HF
·5515 PRINT"[DOWN]"TAB(6)"PRESS [WHITE][R
 VSON] F3 [RVSOFF][YELLOW] TO SELECT SHIE
 LDS"                                      NP
·5520 PRINT"[DOWN]"TAB(10)"PRESS [WHITE][
 RVSON] F5 [RVSOFF][YELLOW] TO START"      DJ
·5525 CO=CO+1:IFCO=15THENCL=CL+1:IFCL=16T
 HENCL=0                                   AH
·5528 IFCO=15THENCO=0:GOTO5482             BC
·5530 GETA$:IFA$=""THEN5525                PN
·5540 IFA$="[F1]"THENL=L+1:IFL=21THENL=1   MM
·5550 IFA$<>"[F3]"THEN5555                 KP
·5551 IFSH=2THENSH=4:GOTO5560              AM
·5552 IFSH=4THENSH=6:GOTO5560              MA
·5553 IFSH=6THENSH=8:GOTO5560              CM
·5554 IFSH=8THENSH=2:GOTO5560              OI
·5555 IFA$="[F5]"THEN5570                  AI
·5560 PRINT"[HOME][12"[DOWN]"]"TAB(20)L"[
 LEFT] ":PRINT"[DOWN]"TAB(21)SH            JJ
·5565 GOTO5530                             FI
·5570 T=0:SC=0:N=1:LV=L:IFL>10THENN=2:LV=
 L-10                                      LO
·5580 POKE53280,11:POKES+24,15:GOTO1000    JE
·6000 DATA 160,0,200,192,255,208,251,96    PD
·6001 DATA 0,0,0,0,0,0,0,0                 FG
·6002 DATA 162,0,206,1,208,232,32,0        EN
·6003 DATA 192,224,24,208,245,96,162,0     CN
·6004 DATA 238,1,208,232,32,0,192,224      IE
·6005 DATA 24,208,245,96,162,0,206,0       II
·6006 DATA 208,232,32,0,192,224,32,208     OB
·6007 DATA 245,96,162,0,238,0,208,232      LD
·6008 DATA 32,0,192,224,32,208,245,96      CE
·6009 DATA 162,0,206,3,208,232,32,0        JL
·6010 DATA 192,224,24,208,245,96,162,0     CN
·6011 DATA 238,3,208,232,32,0,192,224      CO
·6012 DATA 24,208,245,96,162,0,206,2       IK
·6013 DATA 208,232,32,0,192,224,32,208     OB
·6014 DATA 245,96,162,0,238,2,208,232      BJ
·6015 DATA 32,0,192,224,32,208,245,96      CE
·6016 DATA 3,240,0,39,249,0,44,13          FO
·6017 DATA 0,46,29,0,127,255,128,31        LN
·6018 DATA 254,0,63,255,0,35,49,0          JL
·6019 DATA 12,204,0,12,204,0,14,220        HA
·6020 DATA 0,25,230,0,48,195,0,241         NG
·6021 DATA 227,192,241,227,192,0,0,0       GM
·6022 DATA 0,0,0,0,0,0,0,0                 FG
·6023 DATA 0,0,0,0,0,0,0,0                 FG
·6024 DATA 3,240,0,39,249,0,44,13          FO
·6025 DATA 0,46,29,0,127,255,128,31        LN
·6026 DATA 254,0,63,255,0,35,49,0          JL
·6027 DATA 12,204,0,14,220,0,25,230        HB
·6028 DATA 0,48,195,0,241,227,192,241      DI
·6029 DATA 227,192,0,0,0,0,0,0             OP
·6030 DATA 0,0,0,0,0,0,0,0                 FG
·6031 DATA 0,0,0,0,0,0,0,0                 FG
·6032 DATA 1,152,0,3,252,0,15,255          HB
·6033 DATA 0,30,247,128,30,7,128,124       NA
·6034 DATA 243,224,252,3,240,223,15,176    NF
·6035 DATA 203,253,48,213,106,176,206,7    JG
·6036 DATA 48,227,252,112,224,0,112,0      OC
·6037 DATA 0,0,0,0,0,0,0,0                 FG
·6038 DATA 0,0,0,0,0,0,0,0                 FG
·6039 DATA 0,0,0,0,0,0,0                   PD
·6100 DATA 1,1,1,1,1,1,1                   PC
·6101 DATA 1,1,1,1,1,1,1                   PC
·6102 DATA 1,1,1,1,1,1,1                   PC
·6103 DATA 1,1,1,2,1,1,1                   OL
·6104 DATA 1,1,1,1,1,1,1                   PC
·6105 DATA 1,1,1,1,1,1,1                   PC
·6106 DATA 1,1,1,1,1,1,1                   PC
·6107 DATA 0,1,1,0,1,1,0                   OL
·6108 DATA 1,1,1,1,1,1,1                   PC
·6109 DATA 1,1,1,1,1,1,1                   PC
·6110 DATA 0,1,1,2,1,1,0                   AN
·6112 DATA 1,1,1,1,1,1,1                   PC
·6113 DATA 1,1,1,1,1,1,1                   PC
·6114 DATA 0,1,1,0,1,1,0                   OL
·6115 DATA 1,1,0,0,0,1,1                   PL
·6116 DATA 0,1,1,1,1,1,0                   OA
·6117 DATA 1,1,1,1,1,1,1                   PC
·6118 DATA 1,1,1,2,1,1,1                   OL
·6119 DATA 1,1,1,1,1,1,1                   PC
·6120 DATA 0,1,1,1,1,1,0                   OA
·6121 DATA 1,1,0,0,0,1,1                   PL
·6122 DATA 1,1,0,0,0,1,1                   PL
·6123 DATA 1,1,1,1,1,1,1                   PC
·6124 DATA 0,1,1,1,1,1,0                   OA
·6125 DATA 0,0,1,2,1,0,0                   OD
·6126 DATA 0,1,1,1,1,1,0                   OA
·6127 DATA 1,1,1,1,1,1,1                   PC
·6128 DATA 1,1,0,0,0,1,1                   PL
·6129 DATA 1,1,1,1,1,1,1                   PC
·6130 DATA 1,0,1,0,1,0,1                   AH
·6131 DATA 1,1,1,1,1,1,1                   PC
·6132 DATA 1,0,1,2,1,0,1                   AB
·6133 DATA 1,1,1,1,1,1,1                   PC
·6134 DATA 1,0,1,0,1,0,1                   AH
·6135 DATA 1,1,1,1,1,1,1                   PC
·6136 DATA 1,0,1,0,1,0,1                   AH
·6137 DATA 1,1,1,1,1,1,1                   PC
·6138 DATA 1,0,1,0,1,0,1                   AH
·6139 DATA 1,1,1,2,1,1,1                   OL
```

IMPORTANT! Letters on white background are **Bug Repellent** line codes. **Do not enter them!** Pages 87-89 explain these codes and provide other essential information on entering ***Ahoy!*** programs. Refer to these pages **before** entering any programs!

```
•6140 DATA 1,0,1,0,1,0,1                AH
•6141 DATA 1,1,1,1,1,1,1                PC
•6142 DATA 1,0,1,0,1,0,1                AH
•6143 DATA 1,1,1,0,1,1,1                PJ
•6144 DATA 1,0,1,0,1,0,1                AH
•6145 DATA 1,1,1,1,1,1,1                PC
•6146 DATA 0,0,0,2,0,0,0                NN
•6147 DATA 1,1,1,1,1,1,1                PC
•6148 DATA 1,0,1,0,1,0,1                AH
•6149 DATA 1,1,1,0,1,1,1                PJ
•6150 DATA 0,0,0,1,0,0,0                OM
•6151 DATA 0,0,1,1,1,0,0                PG
•6152 DATA 1,1,0,1,0,1,1                PA
•6153 DATA 1,0,1,1,1,0,1                AA
•6154 DATA 1,1,0,1,0,1,1                PA
•6155 DATA 0,1,1,1,1,1,0                OA
•6156 DATA 0,0,0,2,0,0,0                NN
•6157 DATA 0,0,1,1,1,0,0                PG
•6158 DATA 0,1,1,0,1,1,0                OL
•6159 DATA 1,1,0,1,0,1,1                PA
•6160 DATA 0,1,1,2,1,1,0                AN
•6161 DATA 1,1,0,1,0,1,1                PA
•6162 DATA 0,1,1,0,1,1,0                OL
•6163 DATA 0,0,1,1,1,0,0                PG
•6164 DATA 1,1,0,1,1,1,1                OL
•6165 DATA 0,1,1,1,0,1,1                AI
•6166 DATA 1,1,0,1,1,0,1                OC
•6167 DATA 0,1,1,2,1,1,1                AM
•6168 DATA 1,1,0,1,1,0,1                OC
•6169 DATA 0,1,1,1,0,1,1                AI
•6170 DATA 1,1,0,1,1,1,1                OL
```

MATCHBLOCKS
FROM PAGE 41

```
•10 PRINT"[CLEAR]"SPC(4)"[CYAN]M A T C H
 B L O C K S[c 7]"                      II
•20 DIMCR(55),UL(55),UR(55),LL(55),LR(55)
,R(99),T(55),S(25),BK(3),PLA,MATCH      OM
•30 DIM HF(6),LF(6),DR(6):FL=1:TD=720:TRN
=1:POKE198,0                            MK
•40 RESTORE:FORA=1TO27:READCR(A),UL(A),UR
(A),LL(A),LR(A):NEXT                    NE
•50 FORA=1TO6:READHF(A),LF(A),DR(A):NEXT FN
•60 PRINT"[c 7][c A][s *][s *][c R][s *][
s *][c R][s *][s *][c R][s *][s *][c R][
s *][s *][c R][s *][s *][c R][s *][s *][
c R][s *][s *][c R][s *][s *][c S]";:PRI
NT"  [CYAN]SCORE[c 7]":FORA=1TO5:GOSUB90 GI
•70 PRINT"[c Q][s *][s *][s +][s *][s *][
s +][s *][s *][s +][s *][s *][s +][s *][
s *][s +][s *][s *][s +][s *][s *][s +][
s *][s *][s +][s *][s *][c W]":NEXTA:GOS
UB90                                    CK
•80 PRINT"[c Z][s *][s *][c E][s *][s *][
c E][s *][s *][c E][s *][s *][c E][s C][
s C][c E][s *][s *][c E][s *][s *][c E][
s *][s *][c E][s *][s *][c X]":GOTO100  JK
•90 FORB=1TO2:PRINT"[s -]  [s -]  [s -]
[s -]  [s -]  [s -]  [s -]  [s -]  [s -]
  [s -]":NEXT:RETURN                    ND
•100 GOSUB690:INPUT"[CYAN]HOW MANY PLAYER
S";P$:P=VAL(P$)                         JL
•110 IF(P<1)OR(P>10)THENGOSUB640:PRINT"SO
RRY, 1 TO 10 PLAYERS ONLY":GOTO100      EL
•120 GOSUB680:FORA=1TOP:PRINT"TYPE NAME O
F PLAYER";A:INPUTN$(A)                  FH
•130 N$(A)=LEFT$(N$(A),9):L=LEN(N$(A)):PR
INT"[UP]  "N$(A);:FORB=1TO26:FORC=1TOL  DH
•140 PRINT"[LEFT]";:NEXT:PRINT" "N$(A);:F
ORD=1TO15:NEXTD,B:FORE=1TO(21-A*2):FORF=
1TOL                                    LG
•150 PRINT"[LEFT]";:NEXTF:PRINT"[10" "][U
P][10"[LEFT]"]"N$(A);:FORG=1TO20:NEXTG,E BI
•160 PRINT:PRINTTAB(38)"[UP]0[LEFT]":GOSU
B690:NEXTA                              NF
•170 PRINT"DO YOU WANT A MATCH TO BE 2 ID
ENTICAL"                                GP
•180 PRINT"BLOCKS OR 3? (PRESS 2 OR 3)"  MA
•190 GETI$:I=VAL(I$):IFI<>2ANDI<>3GOTO190 OG
•200 GOSUB680:SC=160:M=54:Q=0:FORJ=1TOM:T
(J)=J:NEXTJ:FORJ=MTO1STEP-1             IM
•210 R=INT(J*RND(0)+1):R(J)=T(R):FORK=RTO
J:T(K)=T(K+1):NEXTK                     LB
•220 Q=Q+1:BB=Q:GOSUB650:NEXTJ           EC
•230 FORN=1TOM:IFR(N)>M/ITHENR(N)=R(N)-M/
I:IFI=3ANDR(N)>18THENR(N)=R(N)-18       GP
•240 NEXT                                IA
•250 V=53248:POKEV+21,4:POKE2042,13:POKEV
+41,1                                   HD
•260 FORN=18TO45STEP3:POKE832+N,1:POKE833
+N,255:POKE834+N,128:NEXT               NB
•270 POKEV+4,124:POKEV+5,111             KF
•280 BLK=23:X=124:Y=111:BK(2)=0:BK(3)=99:
PLA=PLA+1:IFPLA>PTHENPLA=1:TRN=TRN+1    JB
•290 FL=1:GOSUB690:PRINT"ROUND NUMBER";TR
N:IFMATCH<M/ITHEN330                    KB
•300 PRINT"[RVSON][UP]GAME OVER":PRINT"[R
VSON]PRESS FIRE BUTTON TO PLAY AGAIN."  AE
•310 A=PEEK(56321)AND16:IFA=16THEN310    BC
•320 RUN                                 II
•330 PRINT"IT IS YOUR TURN, ";N$(PLA);"[8
" "]"                                   ID
•340 POKEV+21,4:POKEV+4,X:POKEV+5,Y:JV=25
5-PEEK(56321)                           OP
•350 IFJV=1THENY=Y-24:GOTO410            GI
•360 IFJV=2THENY=Y+24:GOTO410            KK
•370 IFJV=8THENX=X+24:GOTO410            JM
•380 IFJV=4THENX=X-24:GOTO410            MN
•390 IFJV>10THENROW=(Y-39)/24:COL=(X-4)/2
```

```
4:BK(FL)=BLK:GOTO460                         DJ
·400 POKEV+21,0:FORG=1TO15:NEXT:GOTO340      CH
·410 FORG=1TO60:NEXT:IFY<63THENY=63:GOTO3
40                                           GM
·420 IFY>183THENY=183:GOTO340                PH
·430 IFX<28THENX=28:GOTO340                  JI
·440 IFX>220THENX=220:GOTO340                MD
·450 BLK=(9*Y+X-571)/24:GOTO340              AO
·460 IF(R(BLK)=0)OR(BK(2)=BK(1))OR(BK(3)=
BK(2))OR(BK(3)=BK(1))GOTO340                 GP
·470 POKEV+21,0:PT=1105+(ROW-1)*120+(COL-
1)*3:PC=PT+54272:B=R(BLK)                    EA
·480 POKEPT,UL(B):POKEPT+1,UR(B):POKEPC,C
R(B):POKEPC+1,CR(B):POKEPT+40,LL(B)          DP
·490 POKEPT+41,LR(B):POKEPC+40,CR(B):POKE
PC+41,CR(B):IFFL=IGOTO520                    LL
·500 BK(FL)=BLK:X=124:Y=111:BLK=23:IFBK(F
L)=23THENX=124:Y=135:BLK=32                  EB
·505 IF(BK(1)=23ANDBK(2)=32)OR(BK(1)=32AN
DBK(2)=23)THENX=124:Y=87:BLK=14              NN
·510 FL=FL+1:GOTO340                         BG
·520 IFR(BK(1))<>R(BK(2))THEN580             NH
·530 IFI=3ANDR(BK(2))<>R(BK(3))THEN580       HK
·540 S=54272:POKES+5,15:POKES+6,0:POKES+2
4,10                                         BM
·550 FORA=1TO6:PRINT"[HOME][3" "][RVSON]
M A T C H [RVSOFF]":POKES+1,HF(A):POKES,
LF(A):POKES+4,17                             BB
·560 FORB=1TODR(A):NEXTB:PRINT"[HOME][3"
"][RVSOFF] M A T C H ":POKES+4,16:FORC=1
TO50:NEXTC,A                                 NC
·570 GOTO610                                 CD
·580 GOSUB690:PRINT"[8" "][RVSON] NO MATC
H [RVSOFF]"                                  CC
·590 FORA=1TO30:POKE54296,5:POKE54296,0:N
EXT:GOSUB690                                 DC
·600 SC=160:FORA=1TOI:BB=BK(A):GOSUB650:N
EXT:GOTO280                                  CF
·610 S(PLA)=S(PLA)+1:POKE214,(1+PLA*2):PR
INT:POKE211,37:PRINTS(PLA)                   OD
·620 MATCH=MATCH+1:R(BK(1))=0:R(BK(2))=0:
R(BK(3))=0                                   CG
·630 SC=32:FORA=1TOI:BB=BK(A):GOSUB650:NE
XT:PLA=PLA-1:GOTO280                         CE
·640 FORA=1TO30:POKE54296,5:POKE54296,0:N
EXT:RETURN                                   NP
·650 PT=1009+93*INT((BB+8)/9)+3*BB:PC=PT+
54272                                        LE
·660 POKEPC,14:POKEPC+1,14:POKEPC+40,14:P
OKEPC+41,14                                  PF
·670 POKEPT,SC:POKEPT+1,SC:POKEPT+40,SC:P
OKEPT+41,SC:RETURN                           II
·680 POKE214,21:PRINT:POKE211,0:FORZ=1TO3
5:PRINT" ";:NEXT                             LH
·690 POKE214,20:PRINT:POKE211,1:FORZ=1TO4
0:PRINT" ";:NEXT:PRINT"[UP]";:RETURN         NE
·700 DATA01,233,223,95,105,13,122,76,80,7
9,07,108,123,124,126                         JN
·710 DATA10,77,78,78,77,10,91,91,91,91,03
,32,160,160,32                               DL
·720 DATA07,118,117,118,117,07,76,122,103
,101,13,233,121,95,120                       FD
·730 DATA10,63,63,63,63,10,85,73,74,75,03
,127,32,32,127                               KD
·740 DATA01,102,102,102,102,01,90,90,90,9
0,00,65,65,65,65                             IB
·750 DATA10,83,83,83,83,13,13,13,13,13,10
,79,80,76,122                                AN
·760 DATA03,32,255,255,32,13,121,223,120,
105,13,2,2,2,2                               BN
·770 DATA05,36,36,36,36,03,121,121,106,11
6,07,121,121,120,120                         DD
·780 DATA03,87,87,87,87,03,160,32,32,160,
07,112,110,109,125                           BN
·790 DATA12,143,40,15,210,40,18,209,40,25
,30,150,18,209,40,25,30,800                  PI
·800 PRINT"[CLEAR]":POKE53269,0:RESTORE:G
=1104:FORF=1TO27:READA,B,C,D,E               AG
·810 POKEG,B:POKEG+1,C:POKEG+54272,A:POKE
G+54273,A                                    HB
·820 POKEG+40,D:POKEG+41,E:POKEG+54312,A:
POKEG+54313,A                                NJ
·830 G=G+4:IFG=1140THENG=1264                FC
·840 IFG=1300THENG=1424                      KL
·850 NEXT:FORG=1TO12:PRINT:NEXT              BL
```

VARIABLE MANAGER

FROM PAGE 86

```
·10 REM VARIABLE MANAGER LOADER              NL
·20 SUM=0:BANK15:FORI=6144TO6969:READJ:PO
KEI,J:SUM=SUM+J:NEXT:IFSUM<>88448THENPRI
NT"ERROR IN DATA STATEMENTS":END             KO
·30 SYS6144                                  HD
·6144 DATA 120,173,4,3,141,59,27,173         KA
·6152 DATA 5,3,141,60,27,169,25,141          CD
·6160 DATA 4,3,169,24,141,5,3,88             IE
·6168 DATA 96,160,0,185,0,2,201,64           DP
·6176 DATA 240,3,108,59,27,169,63,141        GK
·6184 DATA 0,255,200,185,0,2,201,67          KL
·6192 DATA 240,9,201,70,240,84,162,11        AK
·6200 DATA 76,145,26,169,62,162,27,32        LG
·6208 DATA 153,26,201,0,240,240,224,0        EA
·6216 DATA 240,236,142,61,27,169,95,162      DE
·6224 DATA 27,32,153,26,201,0,208,222        LE
·6232 DATA 224,0,240,218,142,94,27,173       BN
·6240 DATA 61,27,205,94,27,240,22,176        JP
·6248 DATA 11,56,173,94,27,237,61,27         KJ
·6256 DATA 9,128,208,11,56,173,61,27         CB
·6264 DATA 237,94,27,208,2,169,0,141         NN
·6272 DATA 120,27,169,1,141,58,27,76         FJ
·6280 DATA 172,24,169,62,162,27,32,153       FG
·6288 DATA 26,208,163,224,0,240,159,142      NN
·6296 DATA 61,27,169,6,141,116,27,169        NP
·6304 DATA 255,141,111,27,141,112,27,169     AO
·6312 DATA 0,141,58,27,165,45,133,250        LJ
```

```
·6320 DATA 165,46,133,251,160,0,140,117   AP
·6328 DATA 27,140,118,27,24,177,250,208   FA
·6336 DATA 1,56,200,177,250,144,5,208     KK
·6344 DATA 3,76,135,26,200,177,250,141    KH
·6352 DATA 113,27,200,177,250,141,114,27  KA
·6360 DATA 140,115,27,162,0,142,119,27    BJ
·6368 DATA 238,115,27,172,115,27,177,250  LK
·6376 DATA 208,3,76,117,26,32,178,26      LH
·6384 DATA 176,233,201,65,144,229,201,91  DM
·6392 DATA 176,225,157,78,27,232,200,177  LN
·6400 DATA 250,208,3,76,47,25,32,178      FN
·6408 DATA 26,201,34,240,28,201,36,240    OC
·6416 DATA 36,201,37,240,32,201,40,240    HK
·6424 DATA 28,201,48,144,12,201,58,144    DO
·6432 DATA 11,201,65,144,4,201,91,144     CJ
·6440 DATA 3,76,97,25,76,250,24,140       FF
·6448 DATA 118,27,76,97,25,72,169,1       DM
·6456 DATA 141,119,27,104,201,40,208,5    PP
·6464 DATA 157,78,27,208,28,72,200,177    PB
·6472 DATA 250,201,40,240,9,136,104,157   EO
·6480 DATA 78,27,232,76,97,25,104,157     FH
·6488 DATA 78,27,232,169,40,157,78,27     BG
·6496 DATA 232,140,115,27,236,61,27,240   EE
·6504 DATA 3,76,109,26,202,189,78,27      JN
·6512 DATA 221,62,27,240,3,76,109,26      IH
·6520 DATA 224,0,208,240,173,58,27,208    BB
·6528 DATA 3,76,59,26,165,250,133,36      FA
·6536 DATA 165,251,133,37,173,16,18,133   EK
·6544 DATA 38,173,17,18,133,39,172,115    NL
·6552 DATA 27,173,119,27,240,1,200,174    GB
·6560 DATA 61,27,136,202,208,252,140,125  BD
·6568 DATA 27,132,13,132,109,173,120,27   FL
·6576 DATA 41,127,141,121,27,173,120,27   MC
·6584 DATA 208,3,76,37,26,48,52,56        PO
·6592 DATA 173,115,27,237,121,27,141,115  OO
·6600 DATA 27,24,173,121,27,101,13,133    JE
·6608 DATA 13,198,13,198,109,169,0,141    EE
·6616 DATA 0,255,32,192,93,169,63,141     EK
·6624 DATA 0,255,173,16,18,56,237,121     CO
·6632 DATA 27,141,16,18,176,55,206,17     KF
·6640 DATA 18,208,50,24,173,115,27,109    OL
·6648 DATA 121,27,141,115,27,24,173,121   BP
·6656 DATA 27,101,109,133,109,198,13,198  DB
·6664 DATA 109,169,0,141,0,255,32,215     EB
·6672 DATA 93,169,63,141,0,255,173,16     NJ
·6680 DATA 18,24,109,121,27,141,16,18     NC
·6688 DATA 144,3,238,17,18,162,0,172      IE
·6696 DATA 125,27,236,94,27,240,9,189     AD
·6704 DATA 95,27,145,250,232,200,208,242  JC
·6712 DATA 76,109,26,162,1,189,113,27     OH
·6720 DATA 221,111,27,208,5,202,16,245    KE
·6728 DATA 48,35,173,114,27,141,112,27    NN
·6736 DATA 174,113,27,142,111,27,32,215   AB
·6744 DATA 26,169,32,32,42,27,206,116     MF
·6752 DATA 27,208,10,169,6,141,116,27     NH
·6760 DATA 169,13,32,42,27,173,118,27     IE
·6768 DATA 208,3,76,219,24,24,238,115     LE
·6776 DATA 27,173,115,27,101,250,133,250  MK
·6784 DATA 144,2,230,251,76,180,24,169    AO
·6792 DATA 0,141,0,255,32,135,175,162     JO
·6800 DATA 128,169,1,141,0,255,108,0      BK
·6808 DATA 3,141,172,26,142,173,26,162    CK
·6816 DATA 0,200,185,0,2,240,10,201       FB
·6824 DATA 44,240,6,157,255,255,232,16    DP
·6832 DATA 240,96,72,201,34,240,11,173    IJ
·6840 DATA 117,27,240,3,56,176,22,24      IJ
·6848 DATA 144,19,173,117,27,240,8,169    EK
·6856 DATA 0,141,117,27,56,176,6,169      LG
·6864 DATA 1,141,117,27,56,104,96,141     EC
·6872 DATA 122,27,142,123,27,162,9,142    JD
·6880 DATA 124,27,160,176,173,123,27,221  EL
·6888 DATA 30,27,173,122,27,253,31,27     NA
·6896 DATA 144,15,141,122,27,173,123,27   PI
·6904 DATA 253,30,27,141,123,27,200,208   BO
·6912 DATA 227,152,202,240,17,201,176,240 IO
·6920 DATA 3,141,124,27,44,124,27,48      MI
·6928 DATA 5,173,41,27,240,5,41,127       JL
·6936 DATA 32,42,27,202,16,196,96,1       DO
·6944 DATA 0,10,0,100,0,232,3,16          GE
·6952 DATA 39,32,72,169,0,141,0,255       KL
·6960 DATA 104,32,210,255,169,63,141,0    FG
·6968 DATA 255,96                         NJ
```

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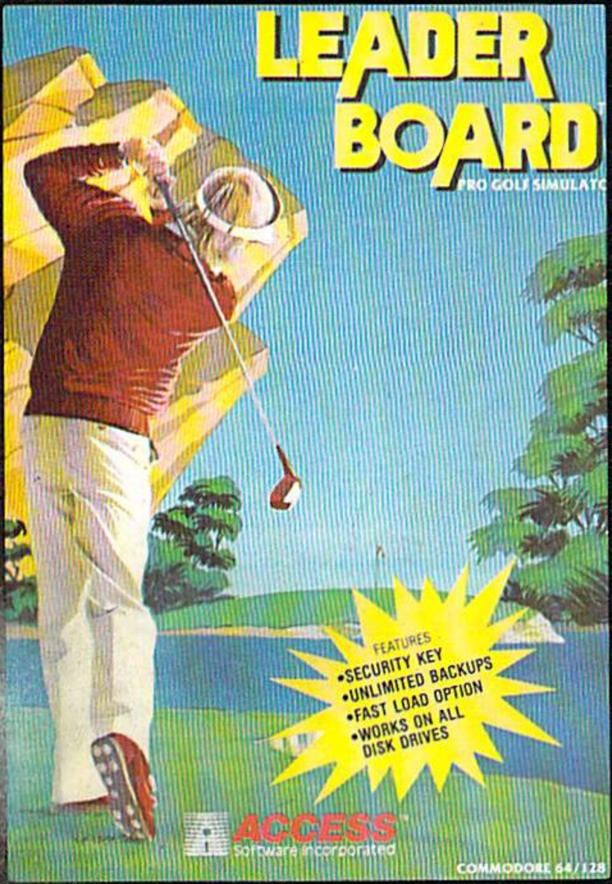
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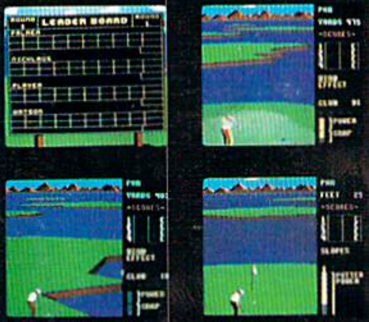


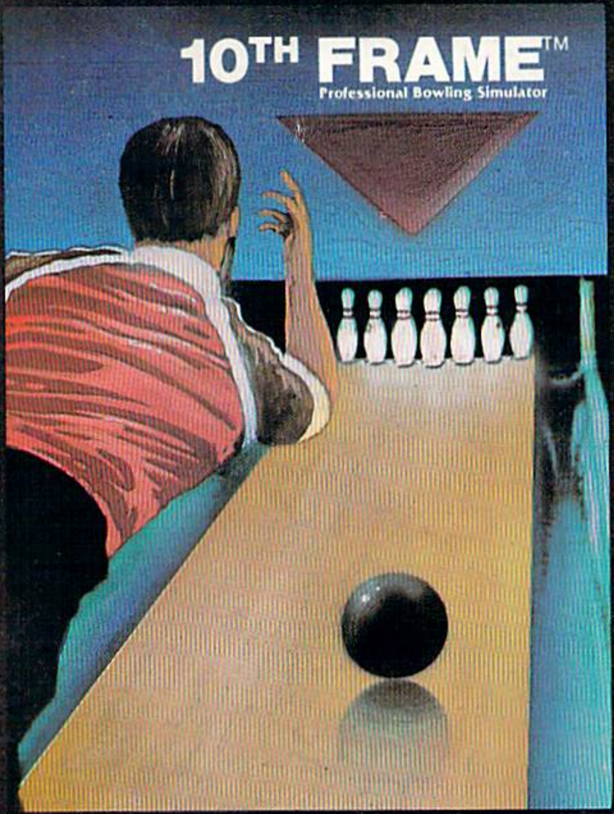
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